The London and North-Western Railway Works at Crewe.

At the recent meeting of the Iron and Steel Institute of Great Britain the afternoon of Wednesday, the 24th ult., was devoted to a visit to the London and North-Western Railway Works at Crewe, a party of 330 being conveyed to Crewe by a special train kindly provided by the London and North-Western Railway Company, the train being hauled by one of Mr. Webb's new compound locomotives. On their arrival at Crewe the visitors were received by Mr. Webb and first conducted to the drawing office, where a luncheon had been hospitably provided by the company. This over, Mr. Webb briefly addressed the members, giving some concise statistics as to the working of the London and North-Western system, and his remarks were of so much interest that we think it best to give them *verbatim*. He said: "It may interest some of the members to know that during the last decade, our mileage has increased some eight millions of miles per annum. Our mileage to-day is over 48 millions of miles. Going into days, hours, and minutes, that means 131,520 miles a day, 5480 miles per hour, 91 miles per minute, and 1½ miles every second of time. This, gentlemen, will represent a journey round the world about every four hours; and I am glad to say that our machinery is so perfect that we can go round the world an average of three times without losing either a split pin or a cotter. To show you what this mileage means, in wear and tear, I may state that we have at the present time 6395 men employed in these works; 8776 at the out-stations; and 605 in the signal department, or a total of 15,776 in the mechanical department of the railway. Our engine stock to-day is 2462, our wagon stock nearly 50,000, and our carriage stock 6000. To show you the progress of the railway during the last twenty years, I have had taken out, as a sample, the weight of the limited mail train. In 1864, the total weight of the carriages was 54 tons 19 cwt., the average weight of each carriage being 6 tons 17 cwt. In 1874, the total weight was 75 tons 3 cwt., and the carriages averaged 9 tons 8 cwt. In 1884, the trains weighed 165 tons 4 cwt., and the carriages averaged 12 tons 14 cwt. each. The problem I have had to solve has been rather a difficult one. It was how to move this weight of train (which is constantly increasing) without having two engines, or without making an engine so cumbersome as to destroy the road. We have endeavored since the meeting of the Institute five years ago to solve that problem by compounding our engines, and thus economising our fuel and our water. It has been stated outside by people who know nothing about it, that I am 'nursing' these engines. I have nursed them to such an extent that I have had nearly a million of miles out of them, the first compound engine, 'Experiment,' turned out two years and a half ago, being responsible for 150,000 miles in that time. When you were here the last time I had the pleasure of showing you a small sample of steel permanent way. Since that time we have further experimented, and we have got at the present time about fifteen miles down on the main line. I hope to be able to show you to-day that this is not a very difficult thing to make; and I trust, for the sake of the steel works in this country, that our railway directors will be prepared to give the thing a fair trial—either the system we have here or some better one. As another item which may interest the members of the Institute, seeing that at present all our steel-making and heating furnaces are on the gas principle, I have had taken out the consumption of fuel in all the furnaces throughout the works. Last year we dealt with 53,844 tons of material, and that in some instances passed through the furnaces twice and sometimes three times. Taking it in that way, it represents 81,685 tons of material passed once through the furnaces. The total quantity of coal and slack used for the gas furnaces was 37,067 tons, or 9 cwt. 8 lb. per ton of iron and steel dealt with. The result of our working on the gas principle is that we are enabled to live in comparative comfort in the town. You will observe that although the works are in full working order, the town is almost smokeless. The flowering plant which you see on the table has been placed there not so much to show what can be grown in Crewe as to show what can be grown alongside of steel works where the furnaces are on the gas principle. It will bear touching without dirtying your hands."—*Engineering.*

Wood vs: Stone Pavements.

As containing data and deductions of general interest we publish a letter written recently by Jas. P. Card, of St. Louis, to O. Chanute, C. E. While the fact that the writer is the president of a wood-preserving company should be given due weight it should be also remembered that he is an expert in this line of practice and has diligently studied all the bearings of the case from a business as well as a constructive standpoint:

"In the first place, it is admitted by all, that it is of little use to lay any pavement without a good and substantial foundation, and none of the substances used require this more than wood.

"Such being the case, a substantial concrete foundation is first laid, and it should cost the same, whether granite, wood, or other material be placed upon it, consequently the only thing to be considered is the cost of the wearing surface, the lasting qualities of same, and its desirability as a pavement when completed.

"In my opinion, the trouble with wood pavements in this country has been:—First. The lack of a proper foundation. Second. The people, generally, have expected a wood pavement, which should have cost as usually laid (with a board foundation,) one dollar and thirty-five cents, ($1.35) per square yard, to last as long as a granite pavement, (with a concrete foundation,) that cost four dollars and fifty cents, ($4.50) or more, per yard.

"Now we will take Broadway, New York, for instance, which is forty-four (44) feet wide, with a concrete foundation, ready to receive either granite, or wood blocks, and suppose granite blocks are laid at a cost of say three dollars and sixty cents ($3.60) per square yard, which would be equivalent to eight dollars and eighty cents ($8.80) per front foot for the abutting property.

"On the other hand, a preserved wood block pavement is laid with blocks say three and one half (3½) inches, by five (5) inches deep, leaving a space of one quarter (¼) to three eights (⅜) of an inch between the rows, to be filled with suitable material, at a cost of one dollar and sixty-two cents ($1.62) per square yard, or three dollars and ninety-six cents ($3.96) per front foot.

"Now what would be the result? The granite pavement would probably last ten (10) to fifteen (15) years with slight repairs, and the wood pavement five (5) to six (6); but for comparison we will suppose the granite to last fifteen (15) years, and the wood five (5).

"The granite costing eight dollars and eighty cents ($8.80) per front foot, the wood three dollars and ninety-six cents ($3.96) for five (5), years or eleven dollars and eighty-eight cents ($11.88) for fifteen (15) years, (allowing two (2) renewals), and deducting seventy-nine (79) cents difference in interest at six per cent. (6 %), would make wood cost for this period of time, eleven dollars and nine cents ($11.09) per front foot, or a difference of two dollars and twenty-nine cents ($2.29) per front foot, equal to fifteen (15) cents per front foot per year more than granite, which is virtually nothing.

"Now in my opinion, the wood pavement would be more likely to last over five (5) years, than the granite to last fifteen (15), but if I am incorrect, who is there living or doing business on a street like Broadway, where property is worth thousands per front foot, that would not willingly pay the slight difference, or many times the difference, to get rid of the incessant noise and confusion, incident to a stone pavement.

"I think the thorough fares should be paved with wood, and the by-streets with granite, or other stone, as it would last indefinitely.

"My reason for using a five (5) inch wooden block is, that when the surface of the street becomes worn down, to the extent of two (2) to two and one half (2½) inches, it becomes so irregular, that the remainder of the blocks, whether two and one half (2½) or five (5) inches, are so softened with moisture, which accumulates in the depressions from rainfall, or by sprinkling, that they soon go to pieces.

Wood on end, if it could be kept dry, would outwear granite, as shown by Col. Flad's tests, made at our water-works here, consequently the dryer the wearing surface is kept the less wear.

"Fully creosoted wood blocks under heavy traffic wear rapidly, as shown on the Brooklyn Bridge, for the reason that the oil keeps the fibre soft.

"There was more wear on the St. Louis Bridge, which is paved with wood, in the two (2) months that the bridge was salted, to remove slush and ice, than in the balance of the year.

"In other words, the principal wear of any wood pavement, occurs during wet weather, and the aim should be to keep the wearing surface of the wood as dry and smooth as possible.

"With a good concrete foundation once down, the wooden blocks could be renewed, when necessary, during night time with little or no inconvenience to travel.

"From a sanitary point of view, the concrete foundation would prevent what most people seem to dread, the leaking through of impurities to the soil beneath, while the treated blocks would disinfect any portion that might enter the same."

Respectfully yours,
JOSEPH P. CARD.

MAJOR LYDECKER in his report to the Chief of Engineers on the operations for increasing the water supply of Washington for the month of September, states that the work on the dam at Great Falls has progressed slowly, the contractors being embarrassed by lack of capital. The space across the Virginia channel for the masonry dam is nearly enclosed on the up stream side by the rip-rap, claypuddled dam, and on the down stream side by a frame coffer dam. The dam proper has been commenced on the Virginia shore, and extended about 190 feet. A large amount of masonry will be laid in October on the Virginia channel The work in the various shafts of the tunnel progressed generally satisfactorily. The total length of the tunnel excavated is 4,569 feet 4 inches, leaving 16,146 feet and 6 inches to be done. The work will be continued during October, as usual. Work was carried on in all parts of the reservoir. The paving of the east by-wash was completed, and the east creek coming in from Soldier's Home turned into it. The dam across the northeast gulch was roughly completed. The work on the main dam was carried on steadily during the month, about 350 men and 175 animals being steadily employed. It is not expected that much will be done on the main connection during October. The remaining work is the laying of the 75 inch pipe, and this cannot be done until the trench is excavated for the reservoir. As the trench is very deep, it will be slow work laying this pipe.

AUSTRALIAN TIMBER.—A Board appointed to inquire into and experiment on the best kind of timber grown in the Australian colonies, and adapted for the construction of railway vehicles, has sent in its report. Among the woods which the commissioners mention as suitable are blackwood, mountain ash, bluegum, and Gippsland mahogany. Under test the blackwood presented results which were superior to any other timber. The mountain ash was second to the blackwood for railway purposes. It should be felled, the commissioners think, during the winter months, when it has attained maturity, and is between 4 ft. and 5 ft. in diameter, and it might remain felled for six months before being broken down into planks, for seasoning. Bluegum should be treated in the same manner. Going somewhat beyond its reference, the Board deals with the question of timber licenses, and recommends that getters be compelled to pay for the timber felled, and to confine their operations to a given area, or otherwise that selected lots of trees be sold by tender. It is also strongly recommended that a forest board should be called into existence.

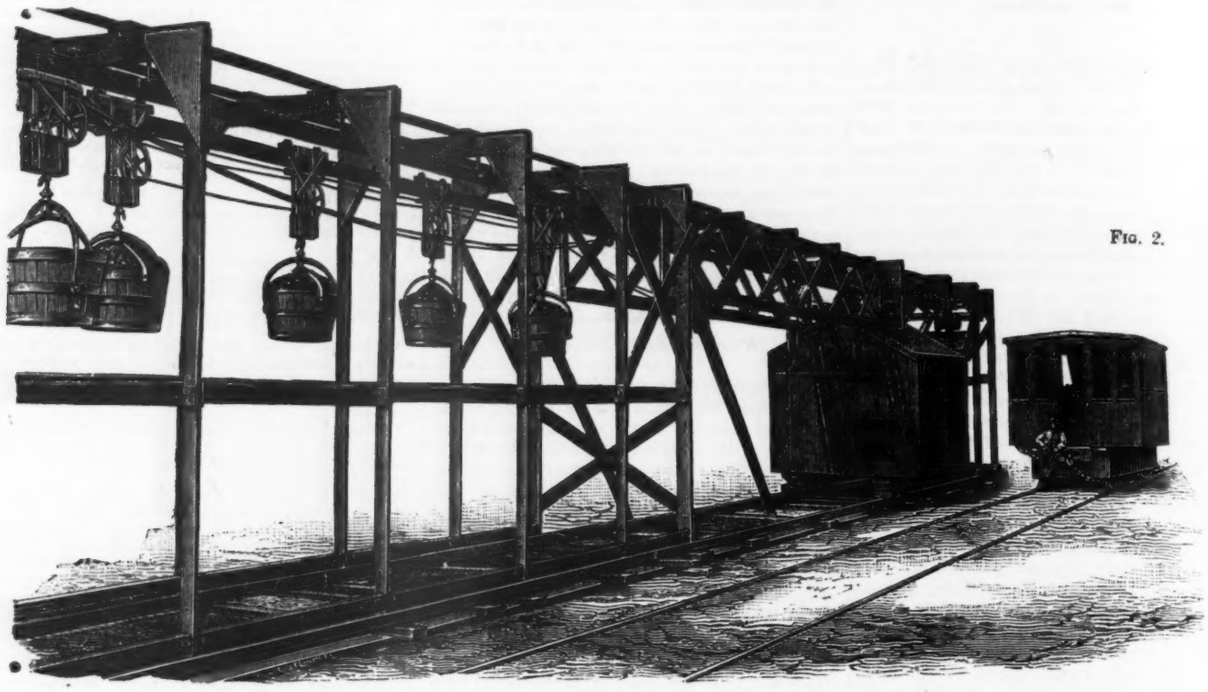

FIG. 2.

Carson's Excavating Plant.

Stoppages of streets and main thoroughfares in towns, caused by excavations for the laying of gas or water pipes, or for the building of sewers, frequently extend over weeks and months, to the great inconvenience of the traffic in our already over-crowded cities; omnibus and tram lines have frequently to change their routes, involving considerable expenditure and loss, and great delay and inconvenience are caused to passengers. To obviate the blocking of streets in which trenching has to be carried out even on a large scale, Mr. H. A. Carson, of Boston, Massachusetts, constructs apparatus of which we publish perspective views Figures 1 and 2, and detail drawings Figures 3 to 8. Machines of this type have been in use in several towns in the United States for some years past and have met with such universal approval that a description of the whole arrangement will no doubt be of interest to our readers. The general perspective view, Fig. 1, was prepared from a photograph of a street in Boston, where, with a road-width of only 25 ft. a trench was made for a sewer 8 ft. wide and 23 ft. below street level. All traffic continued during these operations without any interruption, the space taken up for the plant being little more than that of the width of the trench. The longitudinal section, Fig. 3, gives the best picture of the whole operations. The trench machine is a wooden framework some 12 ft. or 15 ft. high and of a length proportioned to the depth and other particulars of the trenching. This framework runs on a line of rails laid each side of the excavation, so that it can be readily shifted in position when a section of the work is completed. The principal object of this machine is to keep all the work connected with excavating, building, and refilling within the limits of this framework, and to only handle the material to be excavated once, that is, to fill it into buckets at the place of excavation. These buckets are then hoisted up to the top of the framework, where they are automatically attached to little carriers running on rails and worked by ropes from a motor, generally a steam engine, also mounted on a travelling trolly. The buckets filled with material are conveyed to that part of the works where the building operations have been completed, are there tipped, and then run back empty to the excavators. Two lines of rails, and consequently two trains of four or more hoppers, are generally found sufficient for medium-sized works, but in wide trenching both the number of hoppers in each train and the number of trains can of course be easily increased. The hoppers are also used for lowering bricks and other building materials to the trench, handling being as much as possible obviated. Should the trench machine stand opposite a street crossing the one in which excavation is carried on, a part of the cutting can be easily bridged over, and traffic is carried on beneath. Turning now to the details of this apparatus, it will be understood that each bucket is attached to its respective carriage, that the rope which lifts the bucket up to its carriage remains attached to the bucket, and through it the horizontal travel of the carriage and bucket is effected; that the operation of lifting, attaching to the carriage, traversing, and tipping, are all worked from the engine by means of ropes, and that a man only has to put the buckets upright before they return to the excavation. The buckets and carriages are illustrated in detail in Figs. 4, 5, and 6. The carriage consists of two small running wheels *g g* attached to a wooden frame, which carries the rope pulley *r*. Over this pulley passes the rope *m*, which at the end has attached to it an eye bar *l*, into which the hook engages which is fixed to the bucket handle. The bucket is pivotted a little below

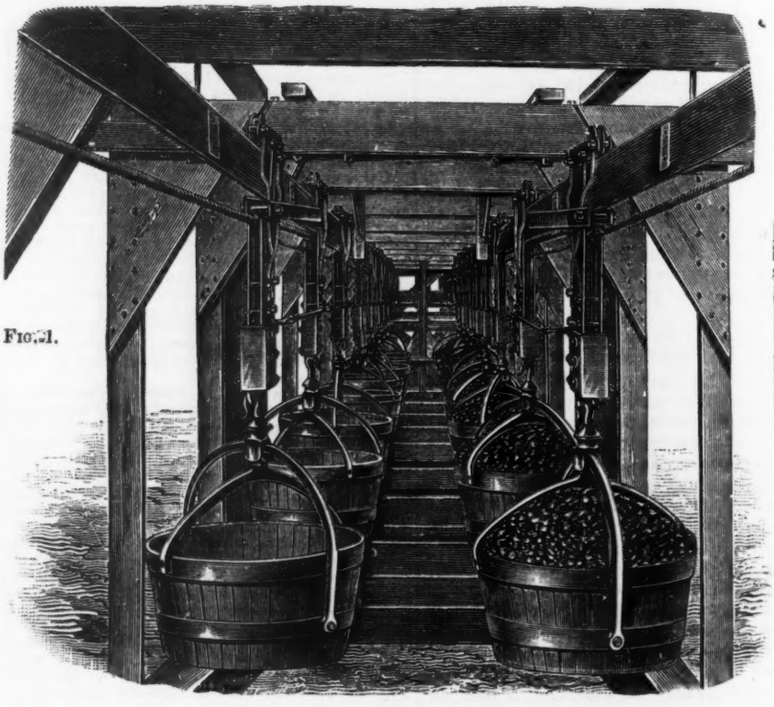

FIG. 1.

CARSON'S EXCAVATING PLANT.

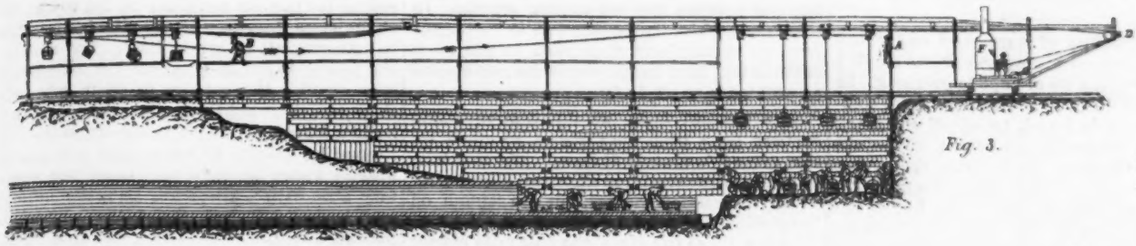

Fig. 3.

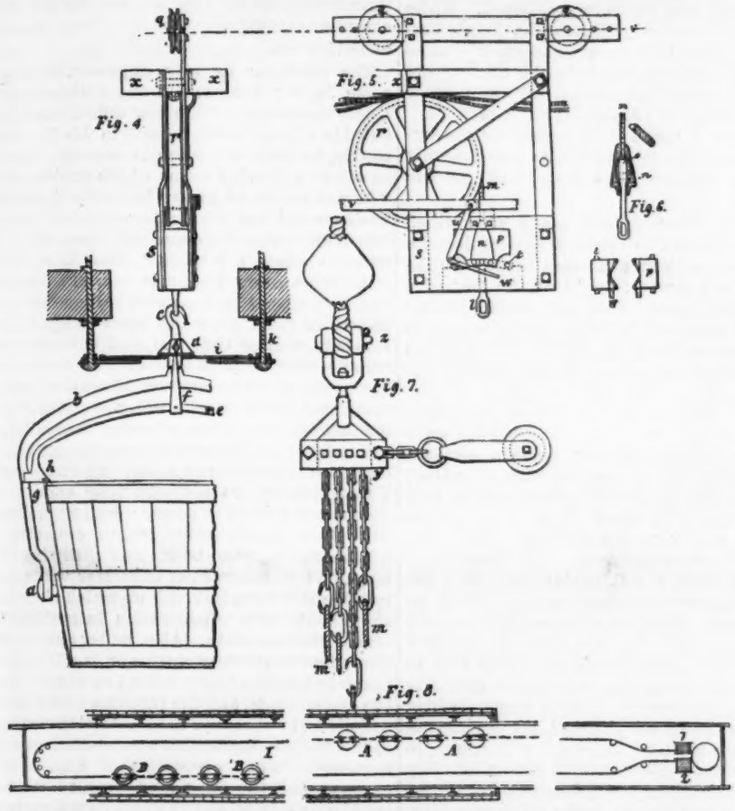

Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8.

its center at *a*, and is provided with a second handle *e*, attached, by means of a bar *f*, to the slide *d*. This slide *d*, at a fixed point in the travel of the bucket, rides on two raised plates *i*, drawing up the handle *e*, which disengages from the notches *g g* fixed on the bucket, and allowing the bucket to tip over. As soon as the slide *d* has passed the plates *i i*, the cross-bar or handle *e* drops, and is ready to be put into the notches *g* again. When travelling in the opposite direction, the slide *d* catches under the hinged plates *i i*, lifts the same up, and no effect is produced on the cross bar *e*.

Turning to the perspective views, it will be noticed that a modification of this tipping gear is there illustrated, the two bucket handles being shown at right angles to each other, and not, as above described, in the same plane. Fig. 2 gives an excellent picture of the framing, the attachment of the travelling rail, the bucket carriages and buckets; it shows two trains of eight buckets just passing each other.

Returning now to the carriage, and assuming the bucket to be drawn up to it, the cone *n* on the rope passes between the two hinged lugs *p p*, pivotted at *n*, and lifts them up until the cone *n* has passed over them, when the lugs *p p* drop and prevent the bucket from lowering again. The whole train of buckets are now drawn from the loading to the tipping port. They are there tipped by means of the automatic gear above described, put into their right position by an attendant, and are then ready to return to the loading station. When arrived here the bar *v*, to which is attached the bell-crank lever *h*, is drawn, the bucket being at the same time slightly lifted; the lugs *p p* are lifted up by means of the bell-crank lever engaging under the pins *w*, and the clutch is now open for the buckets to be lowered to the loading level.

This small diagram, Fig. 8, will best explain the action of the winding drums and ropes; the set A A are the buckets just loaded, the set B B are empty and ready for return; drum 1 is now coupled to the engine, and the rope wound up, until the buckets A A are lifted up to their carriages and the cone *n* has passed the clutch, the drum 1 is then disconnected, and drum 2 coupled to the engine, when the empty train will be drawn into the position of the full, and the full train into position of the empty, each, however, on its own line of rails, the drum 1 all this time following the travel of the train. To drop the buckets in train B B, drum 1 has to be stopped, drum 2 is lifted slightly, the bar *v* is pushed so as to open the clutch, and the buckets are lowered by drum 2, to be filled again, when the operation above described is repeated. Stops *x x* on the carriages, and buffers on the framing, are provided to secure the exact place for stopping, and a signal or call-boy A is placed over the loading station to give the signal for hoisting up, etc. So as not to lose time in loading while the train travels from end to end, a third set of buckets are provided at the loading station, which are hooked on in place of the empty buckets as soon as the empty train arrives. Fig. 7 is a detail view showing how in case of four buckets, the four ropes *m m* are joined together by means of a yoke *y*, to which a single hauling rope is attached at *z*. In this way the simultaneous lifting and lowering of any number of buckets is insured.— *Engineering.*

The Massachusetts Boundary.

Those who have studied the map of Massachusetts can not but have noticed the peculiar appearance of a portion of the Connecticut boundary line just southeast of Springfield. The point referred to is a small square block at the town of Southwick, extending from this state into that of Connecticut. Although the peculiar jog on the map has often been noticed and commented upon, it is not generally known that this very point was for years the foundation for a most bitter controversy between the two states. From 1774 to 1804 the question of division came several times before special committees and commissioners from Massachusetts, and town meetings were frequently held to settle the matter. In 1774 Connecticut attached a portion of land to Southwick, south of the original colony line. Ten years afterward, in 1784, a committee from Connecticut was appointed for the purpose of establishing the bounds at this point, but so tenacious was each colony of every inch of territory that it took more than a score of years to settle this very trifling matter.

Two boards of commissioners were appointed by Massachusetts and Connecticut in in 1793 to ascertain and report the exact boundaries of Southwick, Sandisfield, New Marlboro, and farther west to the New York state line; and four years later, in 1797, joint commissioners were appointed to establish the line east of the Connecticut river. The Connecticut commissioners reported that the line was nearly all correct except the tract of land in question, a block about two and one-half miles square at Southwick, which Massachusetts thought she should have to compensate her for the town she had lost. This the commissioners refused to grant in 1801; but this state was willing, in 1808, to compromise, so one year later it was arranged that Connecticut should keep a slice of Southwick, and Massachusetts should hold the land west of the ponds in that place, the same indentation into the Nutmeg state which she now holds today. In May, 1810, Connecticut appointed another committee to examine the line east of the Connecticut river, but of the result no report can be found among the records of that state. In May, 1822, however, the reports show that the commissioners agreed in all points, as in 1713, with the exception of the gore at Union. As the southeast corner of Woodstock had extended into Massachusetts 120 rods, and the northwest corner forty-eight rods, a jog had been left in the colony line between Woodstock and Union. This was the only jogged point at issue in the report presented in 1822. This jog was corrected in 1826, when the commissioners report was agreed to by both states, and the long and tedious boundary line controversy between Massachusetts and her sister came to an end. The line of the New Haven and Northampton railroad now runs directly through the jog connecting the two states, and Southwick ponds, celebrated locally as a summer resort, lie partly in this state and partly in Connecticut.— *Boston Globe.*

Responsibilities of Surveyors and Engineers.*

BY HERVEY B. FATOUT, INDIANAPOLIS, IND.

The responsibility of Surveyors and Engineers, to whomsoever may see fit to employ them, is something we are apt to overlook. In our hurry and flurry to get into the field, compass and chain in hand, to lay off and mark the lines and corners of some farm, we are apt to work regardless of the fact that the easiest thing a surveyor can do is to make a mistake, and the most difficult task is to follow the tracks, if they can be found, of the Government Surveyor, or, perchance, some Ex-County Surveyor whose footprints are plainly discernible in the form of line trees, and witness-trees pointing to quarter, quarter-corners ten or fifteen feet out of line, the line having been run with a compass with crooked sights or a transit that did not reverse nearer than 20 or 30 feet in a half mile. The more crooked and worse the work that has gone before the more responsible is the position you have to fill when called upon to go over that work.

The law, as I understand it, makes it the duty of the surveyor to trace the old line. Sometimes that duty is very perplexing, as, for instance: The Government survey in this part of the State established corners at section and half-mile corners only, and it is reasonable that the line from the section corner to the half-mile corner should be perfectly straight. Some County Surveyor before you has re-established the half-mile corner from the Government witness, when making a survey of the farm on one side of that line—the line is still straight—afterwards another County Surveyor cuts the adjoining farm into four or five tracts with all the corners on this half mile.

These corners remain the required length of time to make them lawful corners, and then you are called upon to run a line for a road, the center line of which is this half-mile line, with both surveys on record. You find the quarter corners all right; but the intermediates, no three of which are in the same line, are all on the wrong side of the line for the farm for which they were set. Now in that state of affairs the surveyor must do a little thinking; he is placed in the position of a judge, but with precious little authority. 1st. The Government line had been straight for forty years before those other corners were set, and then these corners gained their residence, simply because the party owning the adjoining farm did not object in the required length of time.

I believe it is the duty of the last surveyor to follow the Government line and pay no attention to these incorrect corners, incorrectly set on the wrong line. Sometimes too, the half-mile corner has been re-established, with a corner stone and witness trees, and improvements made accordingly, and a road made.

In after years the surveyor finds a clear place in which to run a line, and he finds the half mile point to be in one or the other of the fences instead of the center of the road, and the witness-trees all gone; and now comes the oral testimony; as you do not know where to dig for any thing, you will generally find several honest old farmers living in the neighborhood, who can go and step within a foot of where they saw a certain surveyor plant that rock; but, it is seldom the case that any two farmers are nearer together than four or five feet, and sometimes they are ten or twelve feet apart, and it is easily seen that they know but very little, if anything at all, about the corner. By this time the surveyor will see his responsibility rising up before him with a prominence, that would make him feel like being miles away in some other business.

In the first place, we assume that the Government Surveyor always made straight lines, and in the second place that the measurement was correctly made, and the half mile corner midway between the two section corners. In this county, heavily timbered as it was, some portions swampy and other portions hilly, it is astonishing that the Government survey was as well made as we find it.

As a general thing we find that the chain carriers have been very liberal, so much so, that some 80's contain 84 acres. The half mile corners are generally, in distance, midway between the section corners, but are seldom on the straight line, and the straightest lines we have are those run since the half mile corner was lost and afterwards reestablished. While it might not be exactly right for the County Surveyor to get up in the court and swear that he placed the new corner where the old one did stand, any opposition can not very well swear that the corner did stand anywhere else.

Therefore I think it is better for the surveyor, when nothing else can be found, to rely more on straight lines than work on bad testimony.

One of the most difficult tasks with which the surveyor has to contend is poor descriptions, many of which abound in our Indian deeds. For instance: begin at the foct of a bridge over the mill race and running to the corner of somebody's wagon shed; thence to an elm tree on the bluff; thence, following the bluff to somebody's lane; thence north to the section corner. The surveyor goes to the appointed place at the appointed time, finds the two parties so antagonistic toward each other that neither one can speak a pleasant word, and whichever one succeeds in getting the first private talk with the surveyor is very closely watched by the other man, who grows snappish and very knowing, and gives the surveyor to understand that he was sent for to settle that dispute and that he must do his duty. The surveyor starts out and finds no mill race, no bridge, no wagon shed, no elm tree, and no lane. By this time the surveyor is beginning to perspire pretty freely and to wonder how he can get out of this difficulty and satisfy the parties. I have about decided that unless I can see through the description with satisfaction to myself, I will refuse to have anything to do with that survey till they give me something by which I can go, or unless there is a chance to make a compromise, which is something I try in most of the disputed cases—that is, where the deed is indefinite and there is nothing by which to locate the corners. I believe it is better for the surveyor to reason with or coax the parties and get them to see that neither one can do any more than spend money in a lawsuit, as neither one can prove anything. Very often though, the compromise cannot be made, the parties rush into law with full pockets and come out empty handed having spent ten times as much as the area disputed is worth, and perhaps not settled the dispute. In surveying town lots in our little country towns and in some of our cities, too, we surveyors must use a great deal of judgement if we expect to be successful.

Very few of our towns have lots of the same size, and very few of the plats of those towns give the size of all the lots, especially the irregular ones.

When the surveyor is called upon to stake a lot in one of these towns, the people as a general thing imagine it little work; but the surveyor very often finds that he can stake that lot with less satisfaction to himself and to the parties, perhaps, than he could make the survey of a large farm. Many of these plats have been placed on record without having been seen by a surveyor, and in many cases, the owner of the lots made the first survey with a clothes line or grape vine. Whenever he sold a lot, being of a liberal turn, he would measure from the last stake, and throw in two or three inches for good measure, or if the last lot is fenced he will measure clear of fences.

Sometimes the surveyor can learn a little by asking for the old residents of the town; but at the same time he must use a little discretion in believing all he might hear. Too many of the people do not seem to see the necessity of perpetuating the corners to their lots, and then, too, there are those who will, when they build a fence, take in six inches from the next lot and be willing to swear that the post is exactly where the surveyor placed the stake. City authorities, also, who, knowing nothing and caring still less about the corners in making street improvements, will in a week's time destroy on one line all the corners, witnesses and landmarks that have been making in forty years.

The surveyor or city engineer, too, must come in for his part in the little comedy. Under the mantle of his new office, before he cuts his wisdom teeth, he will, in his knowing moods, be very apt when in crowds to speak in not very glowing terms of his predecessor; "*he* was a man who knew but little about the business and was not at all careful, but *I* know how it should be done and will move the old stake to where it belongs." Now is it at all strange we often hear this remark, "A half dozen surveyors have surveyed along here and no two of them gave the same point." and also is it strange that the real surveyor has trouble when he finds this kind of work. As engineers, when we start out to work with anything that has to do with water, we may think it a little matter—the word water is small, but the article itself is a mountain in the engineer's path, not easily thrown aside. In ditch work I fear that we do not take time enough in going over a ditch to become well acquainted with it—to note number, length and size of tributaries—acres to be drained—hilly land or level, and whether or not the water will come into the ditch rapidly, all of which elements should enter into consideration in getting the size of the new ditch. Also, under our Circuit Court Law the County surveyor is a Drainage Commissioner and very often has to help with the assessments, and the rapid traveling along a ditch will not always be beneficial in arriving at the desired result with any great degree of accuracy. What proportion if any, of the expense shall the hilly land bear to the flat land by its side, when the water runs from that high land down to the flat land through which the ditch runs? But, in point of fact, this ditch does not afford any better drainage to that land than it had before the ditch was projected. We are very often called upon to run a ditch when the petitioner has failed to place on his notice all lands that would be benefited by the construction of that ditch. As a matter of course we are to work regardless of his notice; but at the same time, owing to the fact that the man who was not notified can refuse to pay any assessment made on his land, and can stop the construction of all that part of the ditch on his land until the law has been complied with, would it not be well for us to tell him of his error, that he may make the correction at the proper time?

Again, some people put a construction on the Ditch Law that does not allow going above the land of the petitioner for the beginning of the ditch, when in fact the entire trouble is above.

It appears to me that a liberal construction should be given to that Drainage Law, and the Drainage Commissioners and Engineers given a chance to do good work. Allow them to go far enough above the land to be drained to catch the head water. Another charge often brought against us, is, that we run water up hill, showing that we are sometimes not careful enough in running our levels; and with poor levels we are very apt to establish wrong grade lines, and thereby have the bottom of the ditch slope the wrong way; but it

* Read before the Association of County Surveyors and Civil Engineers of Indiana, at its Fourth Annual Meeting January 15, 1884.

very often happens that the lay of the land is such that the greatest fall is at the upper end of the ditch, and that the lower end has very little fall, causing sediment to drop when the velocity of the water is checked, and then the engineer is blamed for the filling of the ditch, and showing plainly that the engineer should be very careful in helping to select the route—get it as straight as possible, even if you have to throw away some old ditch, as the water can get away in a straight line with much greater rapidity than it can follow a crooked ditch double the distance across a farm.

The next thing to be done is to carefully take the levels and note the size of any old ditch that may be used in the new, and by so doing you may find that these notes will come handy in case some unscrupulous contractor should construct that ditch and then dispute the number of yards actually moved, for in a dispute of that kind you will almost always find that the contractors will say, if it was a ditch, that the centre was a ridge, and on account of the ridge he moved more dirt, or, if it was a levee, the centre was very low and more dirt was moved; so that the more notes the engineer takes the better off he will find himself in such a dispute. The rivers and creeks, and streams generally, are becoming unmanageable, so much so that levees have become necessary along the bottoms to save the crops. Up to 1875 we did not have much trouble, but these freshets seem to have started the breaks, till now, on account of so much ditching having been done, the streams rise much more rapidly, and come with greater velocity, so much so that banks seem to crumble away before them, the bottom of the stream deepened, very often undermining a bridge foundation, and doing much greater injury to bottom land crops than in former times. The more open a country becomes the more ditching, and in a very few years we will find that our streams will be very expensive things, so much so that we will have hard work to control them or keep them in bounds, and it may become necessary to construct a breakwater at each angle to prevent a break in the levee.

In the construction of these levees we will have to use greater care. Have the base raked clear of foreign matter and plowed, and allow no rubbish to go in the body of the levee, so that no chance will be given the water to follow a stick or corn-stalk through the levee, and start a very small hole that in time will break the levee.

Links and Chains vs: Decimals of a Foot.

The following is an abstract from a communication sent us by Mr. Hosea Paul, formerly of the Public Works Department of the State of Ohio:

After pointing out the difficulty in reconciling the varying units of measure in use among engineers and surveyors and the general awkwardness of the chain and its divisions in the computations of areas, Mr. Paul advocates the use of the foot and its decimals in preference.

The main objection to the change arises from the supposed greater difficulty of computing areas when acres are used. Mr. Paul suggests a remedy for this dread of the factor 43560 and gives the following rule and its explanation:—

Let F = Feet, and A = Area in acres, then, of course, $\frac{F^2}{43560} = A$. And one square foot equals $\frac{1}{43560} = 0.000022956841 \times \text{acres} = m$. Therefore $F^2 m = A$.

As m is a long if not indeterminate decimal we can substitute for it the approximate value, $0.000023 = m'$, which is slightly in excess. Then $F^2 m' = A - c$, in which c is a constant to be deducted, the value of which is found as follows: Let $F^2 = 4356000$, then will $A = 100.188$ and $c = 0.188$ for 100 acres .00188 for 1 acre.

As it is usual to obtain areas by means of triangles, first dividing by 2, we can apply the same method to this rule. For $\frac{m'}{2} = .0000115$, which value may be substituted whenever more convenient.

Expressing this operation in the form of a rule, we have:—To obtain areas in acres from square feet. First point off six places of decimals and multiply, if in triangles, by 11.5, otherwise by 23. The result will be the approximate area in acres from which deduct 0.188 for each hundred acres to obtain true quantity.

The approximation is very close and the correction easily made. For example if the multiplication gives 54.221 Acres, the correction may be set down thus:—

50.00	=	0.094
4.00	=	0.00752
.22 +	=	0.00038
		0.10190

When the tide is at the full, it turns. Our educational methods have been growing in system and severity, if not in perfection, for many years; and the demands upon the pupil have constantly increased, until the necessities for grading have become imperative, and the peculiarities of the individual are almost entirely ignored. It would seem impossible to carry this further, and any change now must be in some other direction. At this crisis, one of the brightest and most fearless of American writers comes forward with a strong argument against the whole system, a protest against the grading and cramming that take so much of the vitality out of the education we are giving to the rising generation. Edward Everett Hale, in the November number of the *North American Review*, makes a plea for "Half-Time in Schools," which every parent and every school board ought to consider seriously. The old question, "Where are we, and where drifting?" was never more forcibly suggested than by another article in the same number, that in which Prof. Gilliam discusses the "African Problem." The facts that he gives as to the increase of the negroes in the United States, their peculiar situation and disposition, and the problem they will force upon us in the near future, call for the gravest consideration. The other articles in this number are: "Woman as a Political Factor," by Judge Robert C. Pitman; "Progress in Naval Armament," by Hobart Pasha, who thinks the United States Government has been wise in not constructing a costly navy; "Friendship in Ancient Poetry," by Principal J. C. Shairp; "Herbert Spencer's Latest Critic," by Prof. E. L. Youmans; "Over-Illustration," by Charles T. Congdon; and "Restriction of the Suffrage," by William L. Scruggs.

A new sort of saw for cutting stone is described in *La Semaine des Constructeurs*. In place of the ordinary long steel blades, supplied with sand to enable them to grind their way into the stone, the new machine presents only a slender endless cord, composed of three steel wires twisted together, which is stretched over pulleys in such a way as to bring the lower portion horizontally over the stone to be cut. The frame carrying the pulleys is movable, so that the cord can be brought into contact with the stone or lifted away from it at pleasure, and the whole is kept in rapid motion, while water falling in drops from a reservoir above serves to moisten the stone. The three wires which form the saw differ from the ordinary kind in being square in section, and by twisting into a cord they are so turned as to present a succession of oblique cutting edges, which act, when set in motion, in nearly the same way as so many small chisels, while the rapidity with which the blows follow each other probably adds to the effect.

What is a billion? In the French system of notation, which is also used in the United States, it is a thousand millions; but the English system gives the name billion to a million million. Sir Henry Bessemer, the famous inventor, who is in the habit of occupying his leisure with curious calculations for the amusement of his grandchildren, tried to convey some idea of the immensity expressed in this little word. He took it successively as a measure of time, of length and of height. Selecting the second as the unit to be used in his first calculation, he began with the startling assertion that a billion seconds have not yet elapsed since the commencement of the Christian era—nor, indeed, even a sixteenth part of that number. A billion seconds make 31,687 years, 17 days, 22 hours, 45 minutes, 5 seconds. In regard to length, he chose for his unit the English sovereign, a coin of the size of a half-eagle. A chain of a billion sovereigns would be long enough to pass 763 times around the globe; or, supposing all these coins lay side by side, each in contact with its neighbor it would form about the earth a golden zone 26 ft. 6 in. wide. This same chain, were it stretched out straight, would make a line a fraction over 18,328,445 miles in extent. For measuring height, Sir Henry chose for a unit a single sheet of such paper as that upon which the London *Times* is printed, a measure of about 1-333 of an inch in thickness. A billion of these thin sheets, pressed out flat and piled vertically upon each other, would attain the attitude of 47,348 miles.

The New Tay Bridge.—In a report to the directors of the North British Railway, dated August 20, Messrs. Barlow and Son, the engineers, say: During the past half year the cylinder foundations of fourteen piers have been put in. The total number of piers whose foundations are in, is 498, leaving thirty-seven to be done. All the four pontoons are now at work sinking foundations. The operations of testing cylinders is now being carried on on both sides of the river with satisfactory results. The new girders for the esplanade at Dundee have been erected, and the erections of girders will continue from that point southwards. All the coffer-dam work on both sides of the river has been completed. The piers for the arching at Wormit are built up to springing level, and the staging and centres for turning the arches are being fixed. The wrought-iron superstructures or shafts of piers are being proceeded with at Glasgow. The ironwork for the girders and flooring of the viaduct is well advanced, and a considerable portion has been delivered at Dundee and Wormit.

The Originator of Steam Navigation.—M. de Lesseps is promoting a statue in honor of the Marquis de Jouffroy, as the originator of steam navigation. The French Academy of Sciences recently named a committee, with the creator of the Suez Canal as its reporter, to specify the part taken by Jouffroy in the important discoveov which has revolutionized navigation. The reporter clearly established the fact, if Papin first conceived the idea, of applying steam as a motive power in navigation, the practical application of the idea was first realized by Jouffroy, who in 1780, built a boat 140 ft. long by 14 ft. wide, which Steamed up stream on the Saone, at a rate of two leagues per hour. This was the first pyroscaph, and it is contended that it preceded Fulton's steamboat by a quarter of a century.

Attention is called by M. Thanneur to the value, for various mechanical purposes, of the timber known as "quebracho" so abundant in Brazil and La Plata. Its diameter is about that of the oak, but it has a shorter trunk, and is used for railway sleepers, telegraph poles, piles, etc., being very durable, specially when well seasoned. It is much heavier than water, and of a reddish color, like mahogany, but becomes darker in time. On account of its hardness it is difficult to work, not being readily cut with an ax. It has been introduced into France, on account of its richness in tannin. A large proportion of Brazilian leather is tanned by the sawdust of quebracho.

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TABLE OF CONTENTS.

	PAGE
The London and North-Western Railway Works at Crewe	193
Wood *vs.* Stone Pavements	193
Carson's Excavating Plant (*Illustrated*)	194
The Massachusetts Boundary	194
Responsibilities of Surveyors and Engineers	196
Links and Chains *vs.* Desimals of a foot	197
Statistical Tables of American Water-works	198
Monument Commemorating the Opening of the Permanent Bridge at Market Street, Philadelphia, (*Illustrated*)	199
Latest Industrial Returns	199
Removing Condemned Machinery by Dynamite	199
Track (*Illustrated*)	200
Correspondence	201
N. Y. and Penna. Boundary Survey	201
The Oceans of the World	201
A Geographical Fan	201
History and Statistics of American Water-works	202
Water	202
News of Week	203
Ohio River Improvements	204

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THE estimates for 1885 sent in by the city departments of New York, amount to about $35,000,000.

IN our short description of the Yonkers Water Tower, in last issue "creamy faced" ashlar should read quarry faced, and the contents of the tank are 40,000 gallons, not "140,000" gallons as there stated.

THE International Meredian Conference at Washington, decided on Oct. 20th that the universal day shall begin at mean midnight and shall be counted from zero up to twenty-four hours.

THE following gentlemen were elected Active Members of the Engineers' Club of Philadelphia, Oct. 4th: Messrs. S. C. McCorkle, Edw. H. Williams, D. C. Barber, O. E. Michaelis, J. B. Hutchinson, C. R. Claghorn, Harry C. Smith, F. H. Bowen, Jr., W. B. Riegner and John Birkenbine.

THE Hell Gate electric light tower was put into service on the night of Oct. 20th. There are nine lamps of 6,000 candle power each run by a No. 8 Brush machine. The light is a great success, making navigation perfectly safe through this difficult channel. The tower is built of iron, is 250 ft. high and 54 ft. square at the base and 5 ft. square at the top.

A SERIES of lectures, recitations and concerts, entitled "The International Star Series" are proposed to be given during November and December, ensuing at Chickering Hall. Mr. Richard A. Proctor, the astronomer, will lecture three times in the course. Mr. W. F. Morse, 18 W. 23d St. is the manager, and by addressing him a pamphlet containing all particulars of the series will be sent.

THE following gentlemen were elected officers of the German Society of Engineers at the Annual Meeting on the 11th inst:

President, Hugo B. Roelker; *Vice President*, Wilhelm Baur; *Corresponding Secretary*, Max C. Budell; *Recording Secretary*, Dr. Joseph Krieger; *Treasurer*, Anton Heim; *Librarian*, M. J. Nolten; *Trustees*, Augustus Kurth, George W. Wundram, T. H. Mueller.

The number of members, according to the latest report, is 288, of whom 163 reside in New York and vicinity and 125 in other States of the Union and in foreign Countries.

THE finest and most thoroughly equipped office building in the world now occupies the site of the old Post Office of this city, at the corner of Nassau and Cedar Streets. We have already published descriptive notes of this building. The Hanover Insurance Company who occupy an elegant suite of offices on the first floor, have just issued a beautiful colored lithograph of this magnificent structure for presentation to their numerous patrons. The publishers are Messrs. Root & Tinker, well-known for their successful specialties in advertising matters.

THE progress in the west heading of Allegheny Mt. Tunnel, South Penn. R. R., for week ending Friday noon Oct. 17th, was 74 ft. Size of heading, 9 ft. by 23 ft. Power, compressed air; pressure 65 lbs.; Machinery, 6 Ingersoll drills; Best single cut 9 ft. Material, hard black slate in beds of 12 to 30 inches, which was easily bored and blasted. The roof was a smooth surface, rising 20 inches per 100 ft., with grade which is 2½ inches per 100 ft. Force 12 men with machines, and 18 laborers loading broken material into cars. Contractor is Charles McFadden; Chas. E. Webster, Resident Engineer.

MR. JAMES L. FRAZIER has been appointed Superintendent of the Chesapeake, Ohio & Southwestern R. R. Co., and will have charge of the practical operations of the same and of the departments connected therewith. The Superintendents of the Transportation, Mechanical, and Road Departments will report to him, and his directions in regard to all matter pertaining thereto will be respected and obeyed accordingly. The office of the Superintendent will be at 258 West Main Street, Louisville, Ky.

Statistical Tables of American Water-works.

We are pushing forward the publication of the Second Edition of the above Tables as fast as the "copy" is furnished us. The entire work has to be rewritten for each edition on account of the numerous additions and changes in the text. There are now about 1,000 water-works listed and nearly all the essential particulars of each are carefully compiled and tabulated from the very latest returns. Only the most untiring perseverance could accomplish what Mr. Croes has, for it seemed as if some water companies were determined that they should not be represented in these Tables. It is no use resisting. Sooner or later, by some means, we will tabulate *every* water supply in America, and refractory managers will eventually be our most active co-partners in forming a complete and accurate exhibit of the water-works interests of this continent.

Mr. Croes is sparing no labor or pains in making a complete and accurate compilation of the vast amount of material which has been received since the issue of the last edition. Some new features will be added which will enhance the value of the publication to parties contemplating a water supply, while it is hardly possible yet from data collected, to satisfy the requirements of every individual interested in water-works construction, maintenance and management, yet we are endeavoring to get as near to that happy position as possible.

Works like this, dealing with the great, and always growing, development of a vast industry, is a labor of years to bring to anything like completeness.

Poor's Manual of the Railroads of the Country, the most akin to it in character, has grown to be a bulky and expensive volume, used as a reference book in every railway office in the land. Croes' Statistical Tables are now equally as familiar a volume in every water-works office in America. It cannot fail to be found in each office, as it is sent there free, under agreement between the publishers and advertisers, and it is not a book that is apt to be thrown into the waste basket.

The book is paid for by the advertising patronage and it is gratifying to us thus far to know that it is appreciated by former patrons, together with many new ones. The following is a list of names whose advertisements are already in type:

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We are also notified of a number more who are preparing "copy" to be sent us. We are very much obliged for this generous patronage and it may be accepted as a certainty that we will place the coming edition with the best selection of addresses so that it will fill the place of an always-ready reference book for anything relating to Water supply. Manufacturers and dealers will appreciate the advantage of this. Engineers and contractors will find it a paying investment to have their names familiarized with their specialty. Whenever we get an inkling of a new waterworks being contemplated we at once mail a copy of these Tables to the Mayor of the town or city, and other copies if it is deemed advisable. It is an advantage to be represented at the earliest stage of proceedings and a card in Croes' Tables is at once cheap and convenient.

We hope to have a very full representation of the water-works interest of America, and we undoubtedly will have, if the above list is any index of such. We trust that intending advertisers will foward "copy" as soon as possible as time is passing rapidly and we will soon be ready go to the binders.

Monument Commemorating the Opening of the Permanent Bridge at Market Street, Philadelphia.

As a matter of engineering interest to the curiously inclined and also of record of a structure soon to disappear, we illustrate this week the monument that at one time stood at the Eastern entrance to the old Market Street Bridge over the River Schuylkill in Philadelphia. This relic now stands neglected in an out of the way corner of the City Gas Works near by, and few even of the citizens of Philadelphia know of its existance or have taken the trouble to read the long inscriptions which set forth with pardonable pride, the record of what was in reality a great engineering triumph for that day.

To briefly sketch the history of a bridge at this point, we will say that the first structure of any kind here built was a floating bridge put in place by Gen. Israel Putnam in 1776; after the battle of Brandywine, this bridge was removed and stored away. During the occupation of the city by the British forces another floating bridge was erected, which, after the evacuation, was removed to Gray's Ferry below, and long did service there. Putnam's bridge was again put into position at Market Street, and did duty until it was swept away by a flood in 1780. It was again replaced and rented for £8,400 but was a second time destroyed on March 15, 1784, and again rebuilt in 1786.

Thomas Paine proposed an iron segmental bridge with an arch of 20 ft. rise and 300 or 400 ft. span for this point, and a company was formed with a capital of $66,666.66. Designs were invited, but before any progress was made all the floating bridges were again swept away by the flood of 1789.

The City Councils, lacking the funds necessary applied to the State for aid. But the first bridge was really erected by a company chartered in 1798, and the work done under the trying conditions outlined in the four inscriptions on the monument given below.

As first erected the structure was a toll-bridge, but on account of a bill passed by the Pa. Legislature, March 16, 1839, authorizing the construction of free bridges over the River Schuylkill, the bridge was sold to the city in 1840 for $80,000, and made "free." It was remodelled in 1849 to carry the tracks of the Penna. R. R. and remained in use until Nov. 20, 1875, when it was destroyed by fire originating in the explosion of a gas main. It was rebuilt by the Penna. R. R. Co. in less than 30 days for a sum of $75,000, and again opened in December, 1875.

When the time arrives for digging up the corner-stone of the eastern abutment, mentioned in the inscription on the monument, the translation of the inscribed legend will probably puzzle the finder. It reads as follows:—

T. F. C. S. O. T. S P. B. W. L. Oct. XVIII.
M D C C C.

According to an entry made in the diary of a contemporary this very much abbreviated inscription was thus explained by John Lewis, the mason who cut it; "This first corner-stone of the Schuylkill Permanent bridge was laid Oct. 18, 1800." When Lewis was asked how he expected after ages would be able to discover the true interpretation of this literal puzzle, he answered; "Why, sir, by the time they will dig up that stone the people will be much more *larned* than you and I be."

The following is a copy of the inscriptions cut upon the four faces of the monument;

North Face.

Dimensions
of the
BRIDGE
Length, 550 Feet.
Abutment
and Wings, 750 Feet
Total, 1300.
Span of smaller arches, each 150,
of middle arch, 194F. 10I.
Width of Bridge, 42.
Curvature of the middle arch, 12;
of the smaller arch 10.
The curves are Catenarian.
Rise
of the Carriage-way, 8 Feet.
Height
over the Platform to the
Crossties, 15.
From the surface of
River to Platform
in the greatest elevation, 31.
Elevated
above all Floods
ever known
in this River.

East Face.

THE BRIDGE
is in itself
the most grateful
REWARD
expected from its
INSTITUTION.
A RECOMPENSE
the most honorable to those
who by liberal advances
and long privation of Profits,
unassisted by public pecuniary aid,
INCOURAGED & SUPPORTED
IT.
And a MEMORIAL
the most acceptable to those
who by enterprising, arduous
and persevering exertions
ACHIEVED
this extensively beneficial
IMPROVEMENT.

South Face.

THE EASTERN PIER
First erected in a
depth of Water of 21 to
24 Feet. The lower course of
Masonry is bolted on the
ROCK.
THE WESTERN PIER
attended with greater difficulties, constant hazards and
unavoidable expense, was
commenced in the midst of
an inclement Winter, within
a Coffer-dam of original and
appropriate Construction,
in which 800,000 Feet of
Timber was employed.
The depth of Water from the
Rock is 41 Feet.
No Pier of regular MASONRY,
in so great a depth of Water is
known to exist in any other part
of the World.
The MASONRY of this pier was
begun on CHRISTMAS DAY 1802,
and erected from the Rock to
low Water Mark in 41 Days and
Nights, after 7 Months had been
occupied in preparing the Dam
and retrieving its Misfortunes.
These Piers are in length, 71F 6I
and in thickness 30 Feet at the
bottom, battering to the top where
they are in length 60F 10I and in
Thickness 19 Feet 4 inches.
The height of the EASTERN PIER from
the Rock, is 40 Feet and that of the
WESTERN PIER is 55F 9I. The first contains
3635 Perches, and the latter 6178
Perches of Masonry.
The EASTERN Abutment is 18 Feet thick and
its wings are founded on the Rock, the WEST-
ERN Abutment of equal thickness and its wings
on a Platform supported by Piles.
Splay of WINGS 60 Feet.

West Face.

THIS BRIDGE
was erected
at an expense of
near 300,000 Dollars
by a Company
Incorporated 27th of April
in virtue of a law
passed 16th of March
1798.
The Coffer-Dams,
Foundations
and other sub-aqueous work
consumed a great proportion
of the Expenditure.
It was Commenced
by laying the first stone of the
EASTERN PIER
after many difficulties had
attended the Dam
on September 5th
1801,
and completed for passage Jan. 1,
1805.
The cover was begun and finished
in the same year.

Removing Condemned Machinery by Dynamite.

Mr. J. J. De Kinder, member of the Engineer's Club of Philadelphia has lately read a paper before that body describing the application of dynamite to the removal of bulky masses of iron in machinery, from which we make the following abstract:—

The iron to be removed was in the two side levers of a Cornish pumping engine. These two levers weighed 57,000 lbs. or 28,500 lbs. each; they were keyed upon a 15 in. shaft and there being no room to drive the keys back and other methods failing of success, it was determined to break the beams in two by explosives.

Each beam was 7 ft. deep and had a sectional area of 509 sq. in.; the shaft opening was 16 in. in diameter; hub 26 in. across by 18 in. deep; web 5 in. thick; top and bottom flanges, 12 in. wide by 4 in. deep. A line of five 1 in. holes was drilled into the web of the beam above the center line of the shaft, and a hole 1¼ in. diameter and 15½ in. deep was drilled into the shaft hub just above the center line and parallel to the shaft. This last hole was tapped for a screw plug 2¾ in. deep; a groove ¼ in. deep alongside this plug was provided for the fuse.

When all preparations were completed the hole in the hub was loaded with a one half pound charge of Atlas powder, No. C. and a common fuse; the plug screwed into place and the charge fired. The result was a sharp report, no damage whatever to the walls or windows—the last open—of the building containing the machinery, and a clean break through the beam.

The time occupied in drilling holes, tapping, charging etc., was about thirteen hours for each beam. The area of one beam was 509 sq. in., the area of holes 48 sq. in., remaining area 461 sq. in., and the ultimate strength of the beam was 8,298,000 lbs. at a tensile strength of 18,000 lbs. per. sq. in. for cast-iron,

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

Rail Tongs, (Fig. 15) made of two pieces of 1 in. round iron 2 ft. 6 in. long with a small piece welded on end to make the jaw. Where they are hinged they are drawn out to $1\frac{1}{2} \times \frac{1}{2}$ in. and held by a $\frac{1}{2}$ in. bolt. Jaws $1\frac{1}{2} \times \frac{3}{4}$ in. thick. Weight 13 lbs. Six to seven can be made in a day.

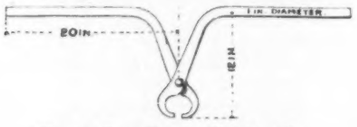

FIG. 15. RAIL TONGS—Weight 13 lbs.

Such are the tools made in the black-smith's shop. The others in the list can be passed over by noticing a few which are not in ordinary use.

Long-handled Shovels have a straight handle about 4 ft. long, and are used in digging post holes.

Scoops are large full shovels for handling cinders, snow, etc.

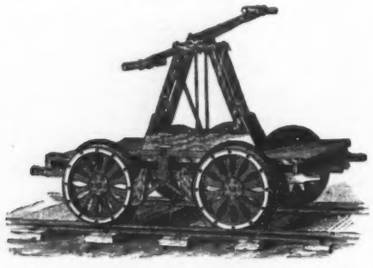

FIG. 10—HAND CAR.

Hand-cars can be made at company shops, but it is about as cheap to buy them from some of the large factories. Fig. 10 represents the Sheffield car with wooden wheels, weighing all told about 500 lbs., as light a car as is made and yet perfectly strong. It has been adopted as the standard of the N. Y. W. S. & B. R. R. and other roads. Such a car can carry ten or twelve men. Hand-cars should be well lubricated on all bearing surfaces, enough to answer the purpose but not a wasteful amount to run down and catch dust and grit. Better oil "little and often." They should be kept in good condition and repair, that is, perfect running order. Otherwise by working hard and running slow they can be made very expensive affairs.

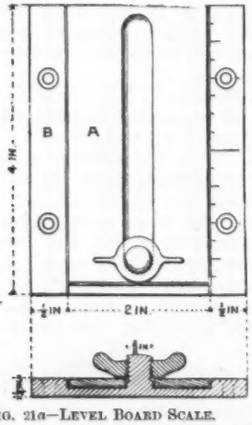

FIG. 21a—LEVEL BOARD SCALE.

A good form of **Grampus** is shown in detail in Fig's. 17 and 17 *a*. The side stringers are held on the journals by the boxes (shown in Fig. 17 *a*) and the cross caps held to them by iron dowels. As each piece is thus separate the car can be quickly taken apart and easily shipped, and with its little wheels set low it is convenient for men to load and unload. If it is not intended to carry extra heavy loads, the scantling of the side bars can be reduced to 5×6 in or 4×6 in.

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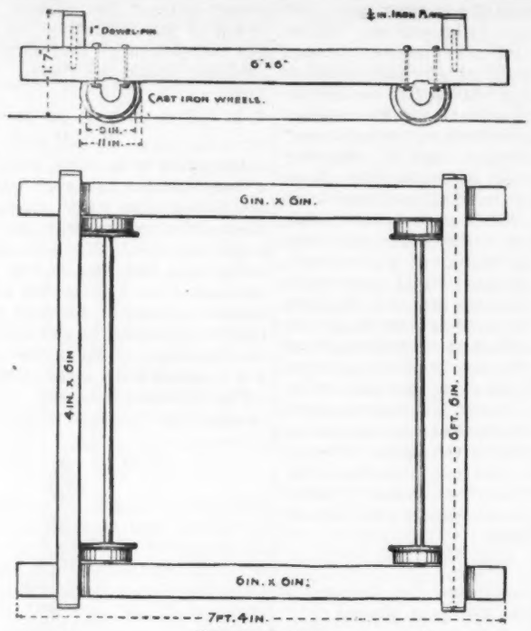
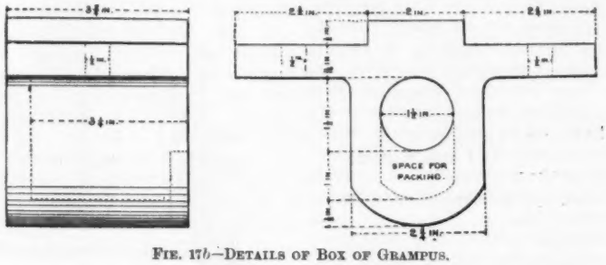


FIG. 17.—GRAMPUS.

Track Gauges, Fig. 18.—In order not to be affected by temperature, but more especially to prevent their being bent they should be made of wood in preference to iron having $1\frac{1}{2} \times 2$ in. well seasoned ash with cast iron lugs screwed on at proper distance for gauge.



FIE. 17*b*—DETAILS OF BOX OF GRAMPUS.

Scythes are of several kinds. There is the common "grass scythe" which is too light for railroad work. Therefore, a slightly heavier form is made called the "R. R. scythe" which can be mounted on the ordinary snath, or else the brush snath which has not quite so much curve. This scythe is used in cutting the ordinary coarse grass and light weeds.

FIG. 19. BUSH HOOK.

Slightly heavier again is the "Bramble scythe" to cut heavier weeds and brambles; while to cut brush and young bushes we have a shorter, stouter scythe called the "Brush scythe." Both of these latter should be mounted on the brush snath. Then to cut bushes there is the "Bush hook" (Fig. 19) a stout hook mounted on an ordinary axe helve. The different varieties are severally needed according to kind of herbage growing on the right of way. But ordinarily a set of "R. R. scythes" and "Brush scythes" with a brush hook, is the most convenient equipment.

Ratchet Drills to bore holes in the rails. Best forms are covered by patents. A good sample is shown in fig. 20, by which any hole can be drilled, or if necessary all four at one setting of the clamp. This clamp should be of such form as to grip the foot and not the head of the rail in order not to be in the way of passing trains.

FIG. 21—LEVEL BOARD.

Level Board, (Fig. 21) 6×1 in. by 5 ft. 6 in. long with a cast iron slide at one end shown in detail in Fig. 21 a. The plate A slides on the plate B, but can be held at any point by tightening the thumb screw; thus one end of the board can be raised a given and exact amount above the other. By marking on the edge of the plate B a scale of inches this difference in elevation can be measured accurately and quickly. The bottom of plate A is widened ½ inch to give better footing. In order to determine when board is horizontal a spirit level is laid on the top edge which must therefore be exactly parallel to the lower. This board is vastly superior in convenience to the ordinary level board with notches cut in one end.

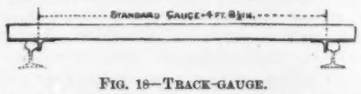


FIG. 18—TRACK-GAUGE.

TO BE CONTINUED.

VICKSBURG, Miss., Oct. 20.—Major James M. Edwards, Vice-president and General Manager of the Louisville, New Orleans & Texas Railroad, to-day awarded a contract to Gorman, Wilson & Lewis to build a tunnel through a large hill on the Louisville, New Orleans & Texas Railroad two miles below this city. The tunnel has been made necessary on account of the bank of the river caving in within about 20 ft. of the track. The tunnel will be over a thousand feet long and will cost a great deal of money.

CORRESPONDENCE.

Cement Pipe.

Special Correspondence Engineering News.

PORTLAND, Oct. 17, 1884.

EDITOR ENGINEERING NEWS:—In a late number of your journal I noticed a communication from Chas. E. Chandler, Civil Eng. of Norwich, Ct., and I take the liberty of addressing a line in reply to his question as to why a Cement Pipe grows heavier and less porous or absorbent with age.

As I understand it, it is by reason of the chemical change of gas into a solid form. As is well known, cement is composed largely of carbonate of lime. The process of burning the cement drives off the carbonic acid gas into the air. In other words, the heat changes the solid into a gaseous form. When the cement has been wet it commences to re-absorb the carbonic acid gas from whatever source it can, from the air, earth etc.—moisture favoring the action. Hence the reason for wetting the pipe every day while curing, and the well known fact that the longer a well-made cement pipe is underground the harder it becomes. This is why it is so generally favored where a good article can be had. To any one interested, I will mail free of expense printed matter on the subject.

Yours truly,

J. W. STOCKWELL.

American Roofing Slate in Japan.

Special Correspondence Engineering News.

No. 5 KAYA YASHIKI, TOKIO, JAPAN, Sept. 23, 1884.

EDITOR ENGINEERING NEWS:—I have been asked by a Japanese architect to obtain for him some information concerning American roofing slates, and I know of no better way of obtaining it than by applying to you and your readers. The gentleman's object is to see if it be advisable to purchase slates in America; for the article is scarce in Japan. He wishes to know the different sizes generally used, more especially the thickness, the number of pieces of each kind in a ton (2240 lbs.), the prices of the various sizes and the freight to this country.

It might be well to inquire also as to the probable percentage of breakage in transit.

Any one sending me the information will confer a favor upon

Yours Respectfully,

J. A. L. WADDELL.

Subdivision of Government Land.

Special Correspondence Engineering News.

FERRYSBURG, MICH., Aug. 8, 1884.

EDITOR ENGINEERING NEWS:—It may assure Mr. Enos, to inform him that he is on the right track, with regard to the subdivision of Government quarter section of land, as he has shown in your issue of July 26.

He should know that the parties named, who teach that the sub-quarter line should be continuous across the whole section, are but writers—or commentators of the law, and probably know no more about it than he does.

As he says, the law fails to give precise instruction for making subdivisions smaller than a quarter section. So that we must fall back on the principle governing other subdivisions, when we shall find that *no dividing line extends beyond the particular tract, or piece of land to be divided.*

Thus, in subdividing a "check," none of the township ranges or parallels extend beyond the particular "check" under subdivision. Again in subdividing a township, none of the ranges or parallels run beyond the particular township to be divided. So, also, in subdividing a section, the quarter lines do not extend beyond the particular section to be subdivided.

From the above, analogy should teach us that *the sub-quarter lines, dividing a quarter section into sub-quarters, should not extend beyond the particular quarter to be divided.*

This question was discussed at one of the meetings of the "Michigan Association of Surveyors and Engineers."—I think in 1881—and settled upon, as above.

H. C. PEARSONS.

N. Y. and Penna. Boundary Survey.

From the start, Major H. Wadsworth Clarke of this city, has been the engineer in charge of the work of establishing the boundary line between New York State and Pennsylvania. The survey started in 1877 with a reconnoissance of the line under the direction of a joint commission from the two States. The condition of the monuments was ascertained. It was found that many of these were missing and that the line varied constantly from the forty-second parallel, the boundary named in the original grant to William Penn. A portion of the land near the boundary line was surveyed when the military tract set aside by Pennsylvania for revolutionary soldiers was laid out, but the only survey of the whole line was that made in 1786.

The survey made at that time was found to be inaccurate at many points. Major Clarke and his associates reported the fact in 1877. The commissioners for Pennsylvania then proposed to have a new survey which should follow the 42d parallel. The New York commission opposed this, and it was finally agreed that a new survey should be made and monuments established on the line run in 1786.

"The work is now nearly completed," said Major Clarke, who has just returned from the work. "We have run the survey about 244 miles and have only about 15 miles more to cover. We have placed 550 granite monuments and have 36 more to set. The work can be finished in four weeks. We started at the point where the 42d parallel and the Delaware river intersects, working westward from there. Much of the work has been in a very hard country. One stretch of 17 miles near the west end we found to be entirely without monuments. The line there was in very bad shape and its errors have been the cause of no end of litigation. It is probable that many of these monuments were removed soon after they were placed by Indians who were hostile to anything that looked like occupation of the land by the whites. When a survey was made for the Holland company in 1799, some of these monuments were missing. The new line varies, of course, from the forty-second parallel; it establishes the survey of 1786, so that there is no change of residence for citizens of either State. The greatest variation was found directly south of Elmira where the line is 1,000 feet north of the parallel. Just east of this is the greatest variation in the opposite direction, which is about 350 feet."

"We had little in the way of records to aid us," continued Major Clarke. "We could find at Albany no diary or records of the original survey, nothing in fact except a map, the formal report and a few private letters. One of these letters informed us that the survey party of a hundred years ago took with them a few barrels of rum, a bit of information that may help to account for the crooked line. Then, too, that surveying party had much trouble with the Indians and experienced great annoyance in the way of lack of transportation facilities. For a good many years valuable papers concerning the original survey were in the possession of the family of Andrew Ellicott, but we learned that his grand-daughter had sold all of them to a paper-rag dealer."

"We have seen little of the commissioners who have the work in charge. The members from Pennsylvania are under pay, but the New Yorkers receive nothing. In fact General Leavenworth is the only one of the commissioners who has favored us with a visit. We met him at Creskill one rainy morning and he inspected a part of the work. We could have completed the survey this fall if the appropriation had held out."

Major Clarke's time will be occupied much of the coming winter in making maps to cover the tracts surveyed during the summer.—*Syracuse Standard.*

WIRE ROPE of the same strength as new hemp rope will run on the same sized sheaves; but the greater the diameter of the sheaves, the longer it will wear. Short bends should be avoided, and the wear increases with the speed. The adhesion is the same as that of hemp rope. Wire rope should not be coiled or uncoiled like hemp rope, but should be wound upon a reel. When substituting wire rope for hemp rope, it is well to allow for the former the same weight per foot which experience has approved of for the latter. As a general rule, one wire rope will outlast three hemp ropes. To guard against rust, stationary rope should be oiled once a year with linseed oil, or kept well painted or tarred. Running rope, while in use, requires no protection. Where great pliability is required, the center or core of wire rope is made of hemp, and small-sized rope is generally made with hemp centers. Running rope is made of fine wire, and standing rope of coarse wire. Wire rope from charcoal-made iron is fully one-fourth stronger than the ordinary rope. The standing rigging of a vessel, when composed of wire rope, is one-fourth less in weight than when of hemp.

The Oceans of the World.

From a work by Dr. Otto Krummul, of Gottingen, we learn the extent of the different seas on our globe. According to his calculations, the Atlantic ocean has a superficies of 49,429,468 miles; Indian ocean, 45,462,040 square miles: Pacific Ocean 99,896,917 square miles. Thus the total superficies of the three large oceans is 194,789,425 square miles. The Arctic ocean has a superficies of 9,481,264 square miles. In the Arctic ocean, Hudson's bay has a superficies of 663,429 square miles, and the White Sea 7,715 square miles; the Australian Sea 5,115,461 square miles; Mediterranean Sea, 1,789,129 square miles; Baltic, 257,589 square miles; Red Sea, 278,944 square miles, Persian Gulf, 146,837 square miles. Then come the seas that Dr. Krummel calls coast seas, viz: North sea, 330,526 square miles; Sea of Great Britain, 126,290 square miles; Sea of St. Laurent, 170,109 square miles; Japan sea, 647,170 square miles; China sea, 761,932 square miles; Sea of Okotsk, 934,717 square miles; Behring sea 1,440,338 square miles; Sea of California, 103,678 square miles. The total superficies of these coastal seas is 4,526,460 square miles. Adding the Antarctic ocean, the superficies of which is calculated at 12,696,236 square miles, the total superficies of all the seas is 231,915,905 square miles, while the total superficies of the continents and the islands of the globe is only 34,354,950 square miles.—*English Mechanic.*

A Geographical Fan.

A geographical puzzle that has troubled many folks is the circular boundary line between the States of Delaware and Pennsylvania. As seen in outline this curious boundary looks like an open fan; at the lower point or handle of the fan is the town of Newcastle; the upper left-hand edge is the point where Delaware, Maryland and Pennsylvania meet; while the upper right-hand point, is the boundary stone in the Delaware River.

In a recent number of the Smyrna (Del.) *Times*, in a long article reviewing the century of litigation over the boundary, H. G. Ashmead thus explains the origin of the circle;

"Although there is a general impression that Mason and Dixon ran the circular line, that is a popular error. Nor is it true, as stated in an excellent article published in a leading American periodical, that 'in the difficulty of tracing this circle was the origin of the work of Mason and Dixon.' The survey of Isaac Taylor and Thomas Pierson in 1701 is the only one ever made of the circular boundary.

"In conformity with the wish of Penn, a conference was held which resulted in a warrant being issued August 28, 1701, to Isaac Taylor, Surveyor of Chester County, and Thomas Pierson, Surveyor of New Castle County, requiring them to meet the Magistrates of the two counties, or any three of them, and

" 'In their presence to admeasure and survey from the town of New Castle the distance of twelve miles in a right line up ye said river and from ye said distance according to ye King's letters patent and deeds from the Duke, and ye said circular line to be well marked two-thirds part of ye semi-circle.'

"The surveyors designated made report that, on the fourth day of the tenth month (December), 1701, in the presence of Cornelius Empson, Richard Halliwell, and John Richardson, Justices of New Castle County, and Caleb Pusey, Philip Roman and Robert Pyle, Justices of Chester County, they ran the division lines, beginning at the point of the radical line which was selected by the Magistrates 'at the end of the horse-dyke next to the town of New Castle.' Thence they measured due north twelve miles, the termination of that distance being 'a white oak marked with twelve notches standing on the west side of Brandywine Creek, in the lands of Samuel Helm;' thence eastwardly 'circularly changing our course from the east southward one degree at the end of every sixty-seven perches, which is the chord of one degree to a twelve mile radius, and at the end of forty-three chords we came to the Delaware River, on the upper side of Nathaniel Lampley's old house at Chester.

"The surveyors then returned to the marked white oak on Helm's land and ran a westwardly course, changing, as before, 'our

course one degree from the west southward at the end of every sixty-seven perches, * * * until we had extended twenty-seven chords, which, being added to the forty-three chords, make two-thirds part of the semi-circle in a twelve mile radius, all of which said circular line being well marked with three notches on each side of the trees to a marked hickory standing near the western branch of Christiana Creek.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E.

(*Continued from page 178.*)

DCLXXXIX. SHERBURNE, N. Y.

Sherburne, Chenango Co., New York, in lat. 42° 37′ N., long 73° 33′ W., is in a rolling agricultural and dairying country on Mad Brook a tributary of the Chenango River.

Water-works were built in 1883 by the village, after plans and under the direction of W. S. Franklin C. E., the supply being taken from the brook, which has a drainage area of about 2,000 acres. A dam of earth 40 ft. high, 10 ft. wide on top with outside slope 2 to 1, and inside slope 2½ to 1, the latter riprapped to a depth of 20 inches, having a core of puddle, was built across the brook forming an impounding reservoir with a storage capacity of 10,000,000 gallons, and being 1¼ miles distant from and 240 ft. above the village. The dam is provided with a masonry waste weir 40 ft. long, and a 20 inch waste pipe passing under the embankment conveys the water, when necessary, to the original bed of the creek.

The water is conducted to the village through a 10 inch cast iron pipe and is then distributed by 2 miles of cast iron pipe of 8 to 4 inches diameter with 14 fire hydrants, and 21 gates. The number of taps is not given. The population in 1880 was 944.

The works are managed by a board of trustees. Wm. E. Davis is Superintendent.

No further information is given.

DCXC. AUDUBON, IV.

Audubon, Iowa, in lat. 41° 40 N., long 95° W., the county seat of Audubon Co. is in rolling prairie land on Blue Grass Creek.

Settled in 1878 it was incorporated a city in 1880. Water-works were built in 1882, after plans and under the direction of Wm. H. Burnham, taking the supply from a well 8 feet in diameter and 22 feet deep.

The water is lifted by a double acting pump of 4 inch cylinder and 18 inch stroke, driven by a wind-mill 25 ft. in diameter, built by the U.S. Wind Engine & Pump Co., to a wooden tank 30 ft. in diameter, 20 ft. high, resting on a timber trestle 24 ft. in height, and being 90 ft. above the well and 65 ft. above the business portion of the town. Distribution is by ¾ of a mile of 6 inch cast iron pipe with 10 fire hydrants, and 12 taps.

Service pipes are of wrought iron. The daily consumption is not known. The population in 1880 was 792, it is now said to be 1,200.

The works have cost $6,500. The bonded debt is $5,600 at 5 per cent. E. J. Freeman, Chief City Marshall has charge of the works.

DCLXCI.

The Massachusetts State Almshouse is at Tewksbury in Middlesex County.

Water-works were built in 1879, the supply being taken from a small brook running through the State lands, and being pumped thence by a Worthington duplex steam pump to two reservoirs, constructed in excavation with stone pavement on bottom and inner slopes, each 150 ft. square and about 9 ft. deep, holding 1,000,000 gallons, and being 74 ft. above the State buildings.

Distribution is by 1 mile of cast iron pipe of 6 inch diameter with 2 fire hydrants.

No further information is given.

C. Irving Fisher, M.D. the Superintendent of the Institution has charge of the works.

WATER.

RED Oak, Iowa, is putting in water-works.

THE City of Nashville, Tenn., will spend $10,000, on new boilers for its pumping stations.

THE Grand Forks, Dak., water-works extension, costing $12,000, is about completed.

THE Sauk Center, Minn., water-works were to be ready for use this week.

ASHLAND, Wis., has let a contract for building water-works in that city, to be completed December 15th next.

PHILADELPHIA has appropriated $90,000 for laying a 20 inch main on Gray's Ferry Road.

ASBURY PARK, N. J., will build water-works. Mr. C.T. Bailey is clerk of the Board of Commissioners.

THE two 10,000,000 gallon pumps recently ordered by the city of Minneapolis are ready to be placed in position.

THE Newport Water-works Company, are making the necessary surveys for the completion of their works at Green End.

THE Clinton, N. Y. Water-works are about half completed. The contractor is D. S. Read of Canajoharie. Cost $27,000.

THE dam of the Ansonia Land & Water Power Co., at Ansonia, Conn., broke again on Oct. 20th while the workmen were building a coffer-dam for repairs.

WORK is being pushed on the water-works at Abilene, Texas. The foundations are ready for the Gaskel pumping engine which is on the road.

MR. TEACY, C. E., is seeking a location for a system of water-works to supply St. Thomas, Ont. He estimates the probable expense at $100,000.

THE Mount Pleasant, Iowa, water-works to the construction of which reference was made in this column Aug. 9th, have been completed and satisfactorily tested.

A CONTRACT for laying mains on Harmon Place, Minneapolis, was awarded to Fred Youngren at 31 cents per foot, and for removing the 8 in. pipe on Third Avenue south, to John Gleason at 33 cents a foot.

SHENANDOAH, Pa., Oct. 20.—Water is so scarce here that but half an hour's supply is allowed out of twenty-four. In Lost Creek and other places the people are supplied from tanks of locomotives. The drought is the severest for many years.

CITY Works Commissioner Fleeman has notified the Board of Aldermen of Brooklyn of the completion of the details incidental to the proposed extension of the water-works, and has asked for authority to issue $500,000 in bonds to purchase 2,211 acres of land on Long Island.

A WELL-ORGANIZED effort is being made to build water-works for the city of Brownsville, Tex. This is meeting with the approval of the majority of the property-holders, and correspondence is being carried on for estimates from contractors.

UTICA, N. Y., is to have a new storage reservoir covering an area of about sixty acres. To flood the above area will require a dam 60 ft. in height, and about 2000 ft. in length. The surveys for the above work have been made under the direction of C. F. Carpenter of Little Falls, N. Y. The water-works are under the control of a private company and the work will be executed by them next season.

CHARLES KELLOGG, formerly President of the Kellogg Bridge Works, Buffalo, has closed a contract with a New York syndicate to furnish 50,000 tons of steel pipe, to be of 36, 40 and 48 in. in diameter. The delivery is to begin within six months, and the contract to be filled within two years. The pipes will be manufactured by a new process, for which application for patents, both American and foreign, has been made. The total amount of the contract is $4,000,000.

AN important decision was issued October 3d, by Lord Kinnear, in the Court of Sessions, Edinburgh, in joint appeals by the Corporations of Edinburgh, Glasgow, Dundee, and Dunfermline, as to whether water-works were subject to valuation. Lord Kinnear finds that in fixing the annual rent or value of the water-works a deduction should be made from the gross revenue of all necessary outlays for management, maintenance, and repairs, which are properly chargeable against revenue. To this extent he sustains the appeal, but otherwise dismisses it, and remits to the assessor to amend the valuation.

THE village of Cobbleskill, N. Y., has decided to build Water-works. The Board of Water Commissioners has been organized, with the Hon. J. S. Pindar, as President, M. D. Borst, Treasurer and Clarence Fox, Secretary. Works will be constructed on gravity system from plans made by W. S. Parker, C. E. Estimated cost about $40,000.

W. S. Parker is now making plans and estimates for Water-works for the village of Greenbush on the Hudson River. Works to be constructed on the gravity system, the supply to be taken from a large spring brook, about two miles east of the village. Two reservoirs will be built of about ten million gallons capacity, with head of two hundred feet above the Hudson River. Mr. G. N. Brandon, is Assistant Engineer.

THE Corsicana, Texas, water-works are in operation and are giving satisfaction.

THE new high service reservoir on Kinsman Street, Cleveland, O., is rapidly nearing completion.

The bottom of the reservoir covers more than five acres, while the whole structure, including the embankments, extends over twelve acres. The capacity of the reservoir will be 36,000,000 gallons, and is calculated to be sufficient to supply all the surrounding territory. The embankments which form the sides are of clay, and are entirely finished with the exception of a gap which was left at the south-west angle to allow the teams to pass through.

The bottom of the reservoir is covered with 6 in. of broken stone, which is covered by 6 in. courses of concrete, making the entire thickness of the lining 18 in. The first course of broken stone is all down and comparatively little concrete remains to be put down. The inside of the embankment is to be paved with stone 10 in. deep laid dry on 6 in. of broken stone. The work has been done in a satisfactory manner by the contractors, Freeman & Hall of Madison, Wis. Mr. Charles D. Bishop is the engineer in charge. The two service pipes are 30 in. in diameter, only one being connected, the other being held in reserve. The water is pumped into the service pipe from the pumping works at the Fairmount Street Reservoir, and this reservoir is intended to receive the surplus when the use is light and to keep up the supply when the demand is heavy. A large 30 in. pipe is situated at the center of the east side, to draw the water off for the purpose of cleaning the reservoir. Another pipe will be placed above this 28 ft. from the bottom, to carry off the overflow. The bottom of the reservoir is 310 ft. above the level of the lake, and with its large capacity ought to supply the high localities for which it is intended for many years to come.

NEWS OF THE WEEK.

Railroads and Canals.

THE Wisconsin Central is now completed to New Richmond.

A NEW street railway is talked of in Davenport Iowa.

CAPT. EADS is exhibiting a model of his Ship Railway in Pittsburgh.

THE surveying party employed by the Chicago, Freeport and St. Paul, is working between St. Paul and Troy, Wisconsin.

THERE has been built this year in Mississippi alone 224 miles of road, an amount greatly in excess of that built in any other State, North or South, in proportion to area.

CHIEF ENGINEER J. A. HINMAN of the San Antonio and Aransas Pass road reports but one bridge necessary between Beeville and San Antonio, a distance of 88 miles.

MESSRS BAXTER and CAMPBELL the commissioners who have in charge the straightening out of the fraudulent survey in Dakota hope to finish by November 1.

IT is proposed to build a railway from Sweden to Lapland, in order to open up the rich stores of mineral wealth in that far-off country.

MR. OTTO J. KLOTZ, recently sent out by the government of Canada to explore the proposed railway line to Hudson's Bay, has returned to Winnipeg. He will report the scheme as not feasible.

MR. W. H. SPRADIN, engineer of the Chesapeake and Nashville has been sounding the Cumberland River, just above the line of the Louisville and Nashville, preparatory to building a railroad bridge.

THE Oregon Improvement Company is constructing the Cedar river extension to the Green river coal fields. It will be a narrow gauge track and will cost from $150,000 to $175,000, instead of $400,000 for the standard gauge first contemplated.

THE "Somerset County Railroad Company," capital stock $200,000, has been chartered at the State Department in Harrisburg, Pa. The proposed road will run from Somerset to Confluence, a distance of twenty miles. The president is Max Schweibenz, of Confluence,

A SMOKE consuming locomotive, designed by Mr. Charles B. Coventry, has been tried recently, with good results on the Chicago, Rock Island and Pacific, and on the Chicago and Northwestern. The novel feature is a return flue boiler.

THE iron and steel works of Crawshay Brothers at Merthyr Tydvil, in South Wales, are about to close. The stagnation of the Welsh iron and steel trades is causing widespread dismay. Other suspensions are probable.

THE Logansport Division of the Vandalia line is now completed to the city limits of South Bend, Ind. As soon as the road is ballasted and otherwise strengthened regular trains will be run over it.

A SURVEY has been commenced at the St. Paul end of the proposed Minneapolis and St. Paul Elevated Railway line, which will be run through to Division Street, Minneapolis, without delay. On this survey an estimate of cost will be made, and the work of the company will be reduced to tangible form.

WORK on the Memphis and Selma railroad was commenced Monday, Oct. 13. The work will be pushed forward to rapid completion, and the gap at present existing between Memphis and Holly Springs, Miss., will be speedily closed. The road will extend to Aberdeen, Miss., and will then be built to Birmingham, Alabama.

THERE are no less than twenty-eight projected roads in the State of Florida, with charters, which have already begun work, or propose to do so at an early day. In Texas the number of railroads chartered at each session of the Legislature averages over a dozen, with a mileage of 1,000 miles.

TRENTON, N. J., October 19.—The new iron bridge over the Delaware River at this point will be opened for traffic to-morrow, and will be entirely completed by the last of the week. The bridge, which cost $50,000, has seven spans of 180 feet each, making a total length of 1,260 feet, or something less than a quarter of a mile.

THE Erie and Wyoming Valley Railroad, a branch of the Erie, was formally opened this week. A train carrying President King and other high officials of the Erie, besides the engineers of the new road, was run over the line. The Chief Engineer of the road is Sebastian Wimmer, one of the best known and most capable railroad engineers in the country.

THE camel has heretofore been shut out from competition as a motive power on railroads by a bloated monopoly of horses. His rights in the matter have been recognized however and he is to be given a chance on the last section of the railroad recently built by Russia through the Trans-Caspian desert, toward India.

IT has been decided to begin work immediately on the 107 miles of railway between Medicine Hat and Fort McLeod, Canada, which the Northwestern Coal & Navigation Company is to build. The road is to be narrow gauge, and the Canadian Government has granted it 1,000 acres of land per mile of road built.

THE permanent survey of the Iowa, Sioux Falls, and Northern Railway has been made for a distance of twelve miles southeast from Sioux Falls. The most difficult portion of the survey has been accomplished, and the surveying party expect to reach Rock Rapids, Iowa, by November 1.

TRENTON, N. J., October 13.—It is stated that the proposed road between Newark and Morristown via Caldwell will be completed without delay. Estimates and plans have been presented and a complete survey of the proposed route made. The new road is to be constructed from Morristown, passing through the Townships of Hanover and Caldwell and at Cedar Grove connecting with the Greenwood Lake Road, over whose rails the cars of the new company will run to Newark and to New York.

THE Government railway proposals recently submitted to the Legislative Assembly of New South Wales comprehend the construction of 1,490 miles of railway, including extensions of 20 different lines traversing some very fertile parts of the colony. Light railways will be used where the nature of the country permits. The total estimated cost of the works is £14,000,000 to be raised in loans from time to time as required, the amount being probably spread over the next seven years. According to the official statement, the net return from the present railways is 4½ per cent on the capital invested.

THE CORINTH CANAL.—The outlay of capital made upon the Isthmus of Corinth Canal works to the close of 1883 was 185,960*l*. The outlay made in 1883 was 92,105*l*. In this sum works properly so called figured for 57,254*l*., and 15,622*l*. was expended upon the construction of two large dredging machines. The balance was represented by interest on shares and expenses of management in France and Greece. The available resources of the company, including its uncalled capital, were estimated at the commencement of 1884 at 970,453*l*. It is officially anticipated that the canal will be completed in the course of 1886.

CHATTANOOGA is to have another street railway.

THE following is clipped from the *Free Grant Gazette* of Bracebridge, Ontario, Oct. 17th:

The contractors on the Northern & Pacific Junction Railway, Messrs. Hendrie, Symmes & Co., are making rapid progress with their work. Although they only started operations at Gravenhurst one month ago, they now have on a force of over two thousand men and four hundred teams. The first twenty-six miles are being operated upon at every available point, and they have also grading gangs on as far north as Katrine. Clearing was also started at the C. P. R. south, last week, and it is the intention of the contractors, to sublet thirty miles of the north end at once, so that track can be laid from both ends simultaneously. The masonry for the first twenty miles has been let to Mr. John Esson, of Toronto. He has bought the gray granite quarry on the Harper property, and has over thirty quarry men and masons busily employed in preparing the stone for the Muskoka River bridges, which are within ¾ of a mile of the quarry. The iron viaducts are being constructed by the Hamilton Bridge Company, and it is expected that the one at Hoc Roc Creek will be erected next month. The contractors confidently expect to complete the whole one hundred and fourteen miles in one year. The work on the first twenty-five miles is heavy, averaging about 35,000 yards of earth and 1,000 yards of rock per mile.

Miscellaneous.

THE City Council of Hamilton, Ont., propose to expend $103,450, on new sewers.

THE following story is told by *Engineering:* "A bought a second-hand boiler on speculation and stored it with B; not being able to 'stick' any one on it in a year and a half, A gave the boiler to B for the storage charged. B sold the boiler to C for $50; C ran it for a while and sold it to D for $90, which was altogether too much profit. D seems to have had a little decency in him, for after working the boiler a little while he sold it to E for only $10 advance on what he paid for it. There is no knowing what price E would have got for it, because, unfortunately, it burst 'on him.'"

MR. K. J. SANDSTROM, Manager of the Am. Forcite Powder Man. Co., of Drakeville, N. J., writes as follows to the Ingersoll Rock Drill Co., of New York:—

"I have always used 'dry air' compressors, from different European constructors (Menck & Hambrock, of Hamburg; Gattoway, of Manchester; Hubsner, of Halle, and Beer, of Liege) but none have so well answered the purpose of furnishing dry and cool air as your compressor. I find in passing compressed air (at 40 lbs.) by a ¼ in. pipe through 1500 lbs. of com. sulphuric acid, during 40 minutes, that the acid takes up only $\frac{1}{10}$ per cent. of water; with other compressors I never found it less than ¾ to 1 per cent. This fact is very valuable for the production of nitro-glycerine, giving about 3 per cent. better yield than I ever got before, thereby during only two months making or saving a greater amount than the entire cost of the compressor.

PHILADELPHIA, PA.—Proposals have been opened for the grading and paving, in the best manner, the entire roadway surrounding the new city hall, and three firms presented bids—viz: H. G. Clement, for noiseless wooden and concrete paving and grading, $3.95 per superficial yard, and the same price for Belgian blocks, with concrete foundation. D. & P. McNichol offered to lay a Belgian block pavement, according to city specifications, and grading for $3.50, or flushed with pitch, 3.80 per yard. The Vulcanite Pavement and Barber Asphalt-Paving companies offered to do the work jointly at $3.15, $3.25, $3.40, and $3.50, according to the thickness, the latter pavement to be of the Trinidad asphalt pattern on a hydraulic concrete base. The subject was referred to a committee. The contract was awarded to this company for an 8 in. concrete base, with a 2½ in. top dressing of Trinidad at $3.50 per yard. This price includes all grading. The work is to be completed in 35 working days, and to be guaranteed for a term of five years. In order to avoid the necessity of tearing up the roadway around the public buildings, at a near period of time, all connections with sewers, water and gas mains around the building will be made before the new pavement is laid, and a subway will be placed all around the building to accommodate all conduits and wires that may hereafter be necessary for electrical purposes. This subway will be about 6'x9'.

BIDS will be received at the office of the Department of Public Works, Commissioner's Office, Room 6, No. 31 Chambers Street, New York, until 12 o'clock M., Friday, Oct. 31, 1884, for sewer Building, Grading and Paving. 18 contracts. See *City Record* for particulars.

WORK preliminary to the new geological survey of the State of Massachusetts authorized by the last legislature, is now in progress in the vicinity of Attleboro, under the direction of Mr. Gresham Bradford and a party of United States engineers. Triangulations are made from measurements observations, and localities accurately fixed. At present the party has its headquarters in Attleboro, and is engaged in fixing the latitude, longitude and elevation of Oak Hill, on which a conspicuous monument has been erected. The height of the hill is found to be 260 ft. above tide water and about 160 ft. above the general level of the town. The surveys have occupied several weeks and are made with the accustomed accuracy. A base line eleven miles in length was established in 1844 by the United States Coast Survey, running parallel with the railroad track and extending from Mansfield to the East Junction. A brick monument near the Mansfield Station on high ground, a short distance from the road, marks the northerly end of the base, from which subsequent measurements and calculations are made.

CONTRACT CONSIDERATION.—The case of Graham vs. Sheets, decided by the Kentucky Court of Appeals on the 2d inst., was one in which a person having a contract with a railroad company to do certain work, after completing a part of it assigned the benefit of the contract to the appellant, who completed the work. It appeared that at the time of the assignment of the contract there was due the first-mentioned party upon the contract a considerable sum, which had been retained by the company to insure the completion of the work, and there was also a quantity of material on hand for which the first contractor had been paid little or nothing. At the same time the first contractor was indebted to the appellant and also to the appellee for work done by them for him under the contract. Appelant, after completing the work, was about to collect the balance due the first contractor, when the appellee brought suit to subject the sum to the payment of his claim, alleging that the appellant at the time of the transfer of the contract, agreed that the back pay should be supplied in payment of both debts. This agreement, it was alleged, was made on consideration of the assignment of the contract, by which the appellant got the benefit of the large quantity of material on hand. The court held that upon the facts as alleged, the agreement set forth was enforceable against the appellant, and that the consideration mentioned was sufficient.

OAKLAND HARBOR. The following is an abstract of the proposals for dredging tidal basin in Oakland harbor, Cal., opened September 23, by Lieutenant Col. G. H. Mendell:

Ed. G. Lukens, Oakland, Cal., 11 95-100c., per cubic yard.

Edgar W. Emerson, San Francisco, Cal., 13c. per cubic yard.

Alexander W. Von Schmidt and John H. Mc Nee, San Francisco, Cal., 16 2-10c. per cubic yard.

Thomas H. Williams, Jr., Undine, Cal., 17c. per cubic yard.

G. L. Long, Mobile, Ala., 17⅓c. per cubic yard.

The contract has been awarded to Ed. G. Lukens.

IMPROVING SHEEPSHEAD BAY.—The following is an abstract of the proposals for dredging Sheepshead Bay, N. Y.:

John McDermott, Cohoes, Md., 57c. per cubic yard.

J. H. Fenner, Jersey City, N. J., 39c. per cubic yard.

Elijah Brainard, Jersey City, N. J., 24½c. per cubic yard.

Edgar M. Payn, Albany N. Y., 46⅔c. per cubic yard.

Atlantic Dredging Company, Brooklyn, N. Y. 13⅓c. per cubic yard.

Contract awarded to the Atlantic Dredging Company.

CURRITUCK SOUND.—The following is an abstract of the proposals for dredging in Currituck Sound, N. C., opened by Captain F. A. Hinman:

Thomas P. Morgan, Washington, D. C., 26c. per cubic yard.

H. E. Culpepper, Portsmouth, Va., 24c. per cubic yard.

George E. Ward, 1001 Md. ave., s. w., Washington, 14½c. per cubic yard.

James Caler & Son, Norfolk, Va., 29c. per cubic yard.

Contract awarded to George E. Ward.

Ohio River Improvements.

THE following are a number of abstracts for the construction of dams and dikes on the Ohio River:

MERRIMAN BAR.

Material Required.

432,800 ft. b. m. oak.
10,900 cub. yds. stone.
2,662 lbs. of spikes.
77 cords of brush.

Aggregate Bids.

John B. Holbrook, Lebanon, Ohio. $23,227.66.
I. V. Hoag, Pittsburg, Pa. $23,532.16.
Simon Carmody and Robert L. Mapel, Cincinnati, Ohio, $26,449.65.
C. B. Willey, Allegheny City, Pa., $27,718.66.
Jacob Friday, Pittsburg, Pa., $27,739.70.
Porter, Tucker & Mahan, New Cumberland, W. Va. $28,650.47.
John Swan, Allegheny City, Pa., $30,917.02.
R. G. Huston & Co., Cincinnati, O., $31,181.42.
Edwin E. Graham, Etna, Pa., $34.696.46.
Wm. B. Rogers, Pittsburg, Pa., $34,722.85.
Jonte, Barton & Crane, Cincinnati, O., $35,755.70.
Merrington & Jutte, Pittsburg, Pa., $36,104.87.
J. Sharp McDonald, Pittsburg, Pa., $43,965.75.
C. J. McDonald & Co., Pittsburg, Pa., $45,441.78.
Contract awarded to John B. Holbrook.

BLOCK'S ISLAND.

Material Required.

345,250 ft. b. m. oak.
138,975 ft. b. m. hemlock.
15,325 cub, yds. stone.
28,057 pounds drift bolts.
4,425 pounds of spikes.
88 cords of brush.

Aggregate Bids.

J. B. Holbrook, $24,098.02, bid withdrawn.
Porter, Tucker & Mahan, $30,150.25.
I. V. Hoag, Jr., $30,360.01.
C. B. Willey, $31,236.94.
Simon Carmody & Robert L. Mapel, $34,573.90.
Jacob Friday, $36,174.42.
R. G. Huston & Co., $39,607.42.
John Swan, $40,776.35.
A. J. Jolly, Sons & Co., Pittsburg, Pa., $47,207.75.
Jonte, Barton & Crane, $48,195.35.
Edwin E. Graham, $49,002.29.
Merrington & Jutte $49,879.73.
C. J. McDonald & Co., $54,450.04.
T. S. Freeland, Robella postoffice, Pa., $181,926.40.
Contract awarded to Porter, Tucker & Mahan.

WHEELING ISLAND.

Material Required.

557,360 ft. b. m. oak.
7,466 cub. yds. stone.
35,806 lbs. drift bolts.
6,600 lbs spikes.
3,000 cub. yds. excavation.

Aggregate Bids.

I. V. Hoag, Jr.. $25,487.22.
C. B. Willey, $26,878.22.
Porter, Tucker & Mahan, $27,237.10.
Simon Carmody and Robert L. Mapel, $28,436.38.
Prince & Kuglen, Wheeling, W. Va., $30,308.98.
Edwin E. Graham, $34,744.16.
Jonte, Barton and Crane, $36,837.82,
Kelly and Ryan. Fairmount, W. Va., $39,396.28.
C. J. McDonald and Co., 440,079.57.
Arnold S. Radford, Wheeling, W. Va. $42,113.20.
J. Sharp McDonald, $50,071.17.
J. C. Wilkins and Co., Uhricksville, Ohio, $79,822.81.
Contract awarded to I. V. Hoag Jr.

CAPINA ISLAND.

Material Required.

234,770 ft. b. m. oak.
94,500 ft. b. m. hemlock.
10,420 cub. yds. stone.
19,080 lbs. drift bolts.
3,010 lbs. of spikes.
60 cords of brush.

Aggregate Bids.

John B. Holbrook, $17,142.25.
I. V. Hoag, Jr., $21,210.57.
R. Merydith & Sons, Marietta, O,, $21.414.81.
Dawes, Irish & Co.. Marietta, O., $21,452.45.
Porter, Tucker & Mahan, $21,601.60.
McGrath & Fickinger, Kingsville, O., $22,709.63.
Simon Carmody and Robert L. Mapel, $53,509.39.
R. G. Huston & Co., $25,173.46.
John F. King, Belpre, O., $26,779.49.
Edwin E. Graham, $29,618.85.
Jonte, Barton & Crane, $33,476.45.
C. J. McDonald & Co., $34,317.55.
A. J. Jolly, Sons & Co., $35,301.86.
J. Sharp McDonald, $40,755.18.
Contract awarded to John B. Holbrook.

FISHCREEK ISLAND.

Material Required.

234,770 ft. b. m. oak.
94,500 ft. b. m. hemlock.
10,420 cubic yds. of stone.
19,080 lbs. drift bolts.
3,010 lbs. of spikes.
60 cords of brush.

Aggregate Bids.

John B. Holbrook, $18,184.35.
I. V. Hoag, Jr., $21,210.51.
R. Merydith & Sons, $21,414.81.
Dawes, Irish & Co., $21,452.45.
Porter, Tucker & Mahan, $21,601.60.
McGrath & Fickinger, $23,123.14.
Simon Carmody & Robt. L. Mapel $23,509.39.
John F. King, $24,059.84.
R. G. Huston & Co., $26,215.46.
Edwin E. Graham, $29,798.85.
Jonte, Barton & Crane, $30,761.45.
C. J. McDonald & Co., $34,317.55.
A. J. Jolly, Sons & Co., $35,736.75.
J. Sharp McDonald, $40,617.18.
Contract awarded to John B. Holbrook.

THREE BROTHER'S ISLAND.

Material Required.

331,440 ft. b. m. oak.
133,416 ft. b. m. hemlock.
14,712 cubic yards stone.
26,952 lbs. of drift bolts.
4,248 lbs. of spikes.
84 cords of brush.

Aggregate Bids.

John F. King, $27,209.07.
Dawes, Irish & Co., $28,33.51.
C. M. Cole, Marietta, Ohio, $28,470.95.
I. V. Hoag, Jr., $29,210.25.
R. Merydith & Sons, $29,133.92.
Porter, Tucker & Mahan, $30,133.92.
McGrath & Fickinger, $30,731.22.
Simon Carmody and Robt. L. Mapel, $33,-192.31.
R. G. Huston & Co., $35,374.63.
J. Sharp McDonald, $37,084.16.
Jonte, Barton & Crane, $40,776.60.
Edward Graham, $42,070.80.
A. J. Jolly, Sons & Co., $45,762.42.
C. J. McDonald & Co., $50,159.10.
J. M. Stum, Little Hocking, O., $57,755.68.
Contract awarded to John F. King.

SAND CREEK.

Material Required.

284,560 ft. b m. oak.
10,311 cub. yds. of stone.
20,813 lbs. of drift bolts and spikes.

Aggregate Bids.

J. C. Graham, Gallipolis, O., $16,545.62.
C. M. Cole, $17,966.78.
I. V. Hoag, Jr., $19,877.52.
Porter, Tucker & Mahan, $20,430.68.
Simon Carmody & Robert L. Mapel, $21,898.-47.
R. G. Huston & Co., $23,509.58.
Jonte, Barton & Crane, $24,835.82.
Sheldon S. Eaton, Covington, Ky., $28,776.75.
F. Keating, $30,240.74.
A. J. Jolly, Sons & Co., $34, 220.97.
C. J. McDonald & Co., $37,115.18.
J. M. Stum, $40,203.03.
Contract awarded to John F. King.

EIGHT MILE BAR.

Material Required.

436,333 ft. b. m. oak.
15,811 cubic yards stone.
31.913 pounds of drift bolts and spikes.

Aggregate Bids.

Ware & Pyle, Cincinnati, O., $22,609.55; bid informal.
J. J. Shipman, Louisville, W. Va., $24,588.74.
J. C. Graham, $26,938.10.
W. H. Wheeler, Sciotoville, O., $27,582.45.
John B. Holbrook, $29,459.74.
Jonte, Barton & Crane, $30,612.61.
P. H. Kelley, Portsmouth, O., $30,885.94.
H. L. Hopkins & Co., St. Louis, Mo., $32,-311.84.
I. V. Hoag, Jr., $33,400.55.
Simon Carmody & R. L. Mapel, $33,587.27.
R. G Huston & Co., $34,958.28.
P. Kendrick & Co., Cincinnati, O., $37,292.36.
L. Hommedien & Bloom, Cincinnati, O., $40,264.67.
Sheldon S. Eaton, $41,482.22.
M. D. Burke & Co., Cincinnati, O., $46,307.64.
C. J. McDonald & Co., $65,250.33.
A. B. Cole, Portsmouth, O., $86,216.01.
Contract awarded to J. J. Shipman.

FOUR MILE BAR.

Material Required.

365,375 ft. b. m. oak.
349,000 ft. b. m. hemlock.
99,982 ft. b. m. pine.
21,175 cubic yards stone.
76,000 pounds drift bolts and spikes.
575 cords of brush.

Aggregate Bids.

Ware & Pyle, $36.542.89; bid informal.
J. J. Shipman, $40,260.78.
Wm. H. Wheeler, $44,329.42.
P. H. Kelley, $47,926.99.
John B. Holbrook, $47,855.80.
I. V. Hoag, Jr., $49,752.64.
Jonte. Barton & Crane, $51,214.87.
H. S. Hopkins & Co., $53,870.01.
Simon Carmody and R. L. Mapel, $54,984.19.
C. B. Willey, $56,555.17.
R. G. Huston & Co., $58,646.02.
P. Kendrick & Co., $59,809.22.
L. Hommedian & Bloom, $64,000.28.
B. C. Howell, Fort Gay, Wayne Co., W. Va., $65,702.78.
Sheldon S. Eaton, $76,664.65.
M. D. Burke & Co., $71,562.62.
A. J. Jolly Sons & Co., $94,526.85.
C. J. McDonald & Co., $92,409.13.
A B. Cole, 125,028.55.
Contract awarded to John J. Shipman.

RISING SUN BAR.

Material Required.

1,350 piles.
7,500 cords of brush.
18,000 cub. yds. of stone.
2,250 lbs. of bolts, nuts and washers,
261,000 ft. b. m. oak.
59,600 ft. b. m. pine.
24,600 lbs drift bolts.
830 lbs. of spikes.

Aggregate Bids.

Ware & Pyle, $44,316.95; bid informal.
Kirk & Co., Madison, Ind., $44,479.40.
P. H. Kelly, $44,912.75.
Simon Carmody & R. L. Mapel, $47,426.
J. J. Shipman, $50,423.50.
Boyer & Stites, North Vernon, Ind., $51,442.55.
I. V. Hoag, Jr., $54,776.70.
P. Kendrick &, Co., $56,929.45.
John B. Holbrook, $57,438.40.
H. S. Hopkins & Co., $62,515.60.
B. C. Howell, $65,446.
M. D. Burke & Co., $68,209.50.
R. G. Huston & Co., $71,226.60.
Jonte, Barton and Crane, $91,455.20.
Hayes, Argo & Co., Cleves, O., $95,370.40.
L. Hommedien & Bloom, $95,683.
Eaton & Stone, North Bend, O., $100,847.
Contract awarded to Kirk & Co.

FLINT ISLAND.

Material Required.

1,996 piles.
17,224 cords of brush.
41,078 cub. yds. of stone.
3,092 lbs. of bolts, nuts and washers.
375,651 ft. b. m. oak.
85,605 ft. b. m. pine.
35,150 lbs. drift bolts.
1,198 lbs. spikes.

Aggregate Bids.

John H. Morris, Evansville, Ind., $78,901.27
Kirk & Co., $93,226.23.
I. V. Hoag, Jr., $96,320.94.
Simon Carmody & R. L. Mapel, $97,753.01.
Joseph Coyne, Jeffersonville, Ind., $110,391.10.
B. C. Howell, $112,947.46.
C. B. Willey, $115.629.99.
J. J. Shipman, $119,804.61.
H. S. Hopkins & Co. $124,005.83,
Lynch, McQuoid & Co., McKeesport, Pa., $134,053.32.
M. D. Burke & Co.. $136,636.96.
R. G. Huston & Co., $146,326.40.
Jonte, Barton & Crane, $241,546.55,
Contract awarded to John H. Morris.

GRAND CHAIN.

Material Required.

1,204,366 ft. b. m. oak.
34,026 cub. yds. of stone.
78,006 lbs. drift bolts.
1,200 cords of brush.

Aggregate Bids.

I. V. Hoag, Jr., $73,769.17.
George E. Shoop, Golconda, Ill., $81,671.08.
Simon Carmody & R. L. Mapel, $82,716.62.
H. S. Hopkins & Co., $83,552.85,
J. J. Shipman & Co., $91, 737.90.
Jonte, Barton & Crane, $116,483.88.
R. G. Huston & Co., $122,779.21.
Contract awarded to I. V. Hoag, Jr.

NEW Orleans wants a bridge across the Mississippi at that point.

MR. CHARLES COLNE, the secretary of the American Committee of the Universal Interoceanic Panama Canal Company, has been lecturing before the Franklin Institute, on the canal.